APRIL, 1952
Vol. 8---No. 2

Lubrication ENGINEERING

ANNUAL MEETING ISSUE

ASLE ANNUAL MEETING AND EXHIBIT
APRIL 7, 8, 9, 1952
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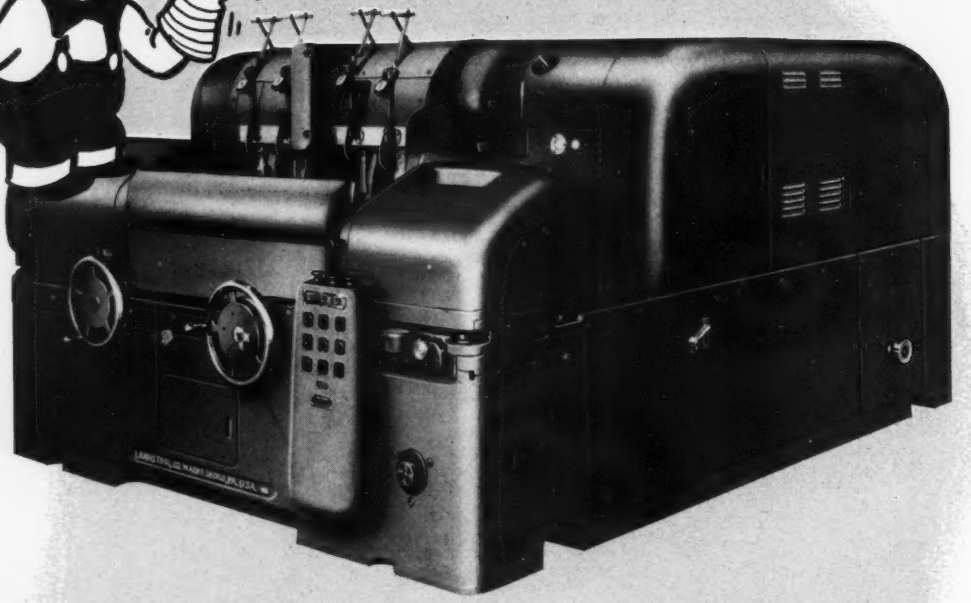
JOURNAL OF THE AMERICAN SOCIETY OF LUBRICATION ENGINEERS

"Trabon OIL AND GREASE SYSTEMS SOLVE THE DESIGNERS' PROBLEMS"



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Lubrication ENGINEERING

VOL. 8 APRIL, 1952 No. 2

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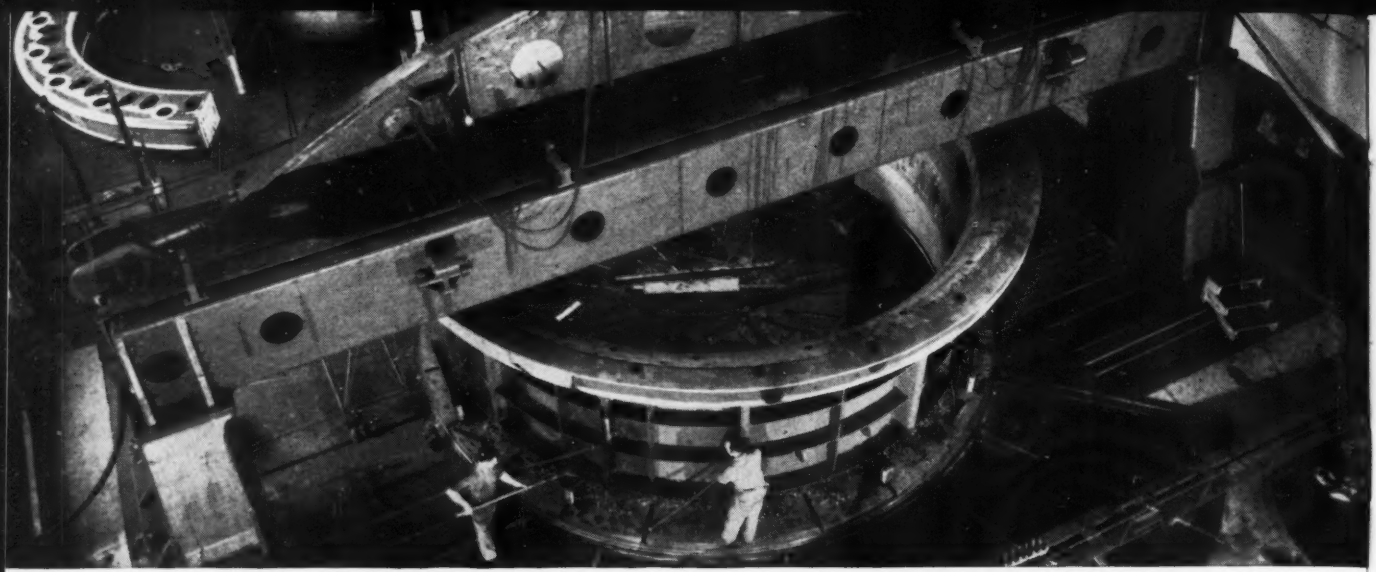

This $400,000 vertical boring mill, one of the world's largest, bores, turns and faces hydraulic turbine parts. Sunoco Way Lubricant, approved by 38 machine tool builders, was selected by the design engineers to prevent stick-slip with resultant poor finishes and scoring of ways and slides. On this machine, even with work as heavy as 75 tons, Sunoco Way Lubricant has never squeezed out.

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CIRCO OILS. Straight mineral oils for general lubrication of industrial machinery. Unsurpassed for once-through applications, regardless of operating temperatures.

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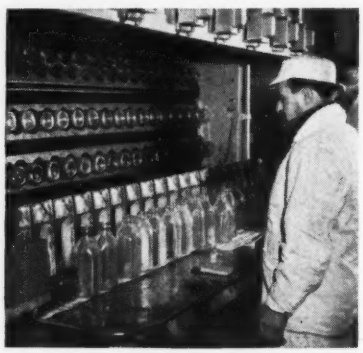

Now 95 bottles a minute can be processed continuously by this washer, thanks to a Sun Adhesive Pressure Grease. In the past, shutdowns were required after short intervals because the lubricant then in use did not adhere, leading to open gear failures.

pumps, low-speed diesels, and general lubrication where a high-quality straight mineral oil is needed.

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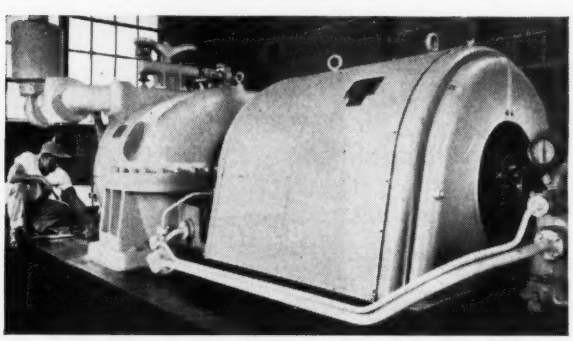

This turbine supplies most of Nantucket Island's power during summer peak loads. In winter it is idle, but journals, bearings and controls always remain free of sludge, rust and corrosion—because Sunvis 916 protects them. Its metalwetting characteristics prevent any moisture present from displacing the oil.

Gates, valves and capstans—the entire mechanism of this new Monongahela River lock—operate hydraulically. The engineers in charge chose Sun Hydraulic Oil over all others because they felt it could be best counted on to keep the lock in operation and river traffic moving despite extremely rigorous conditions.

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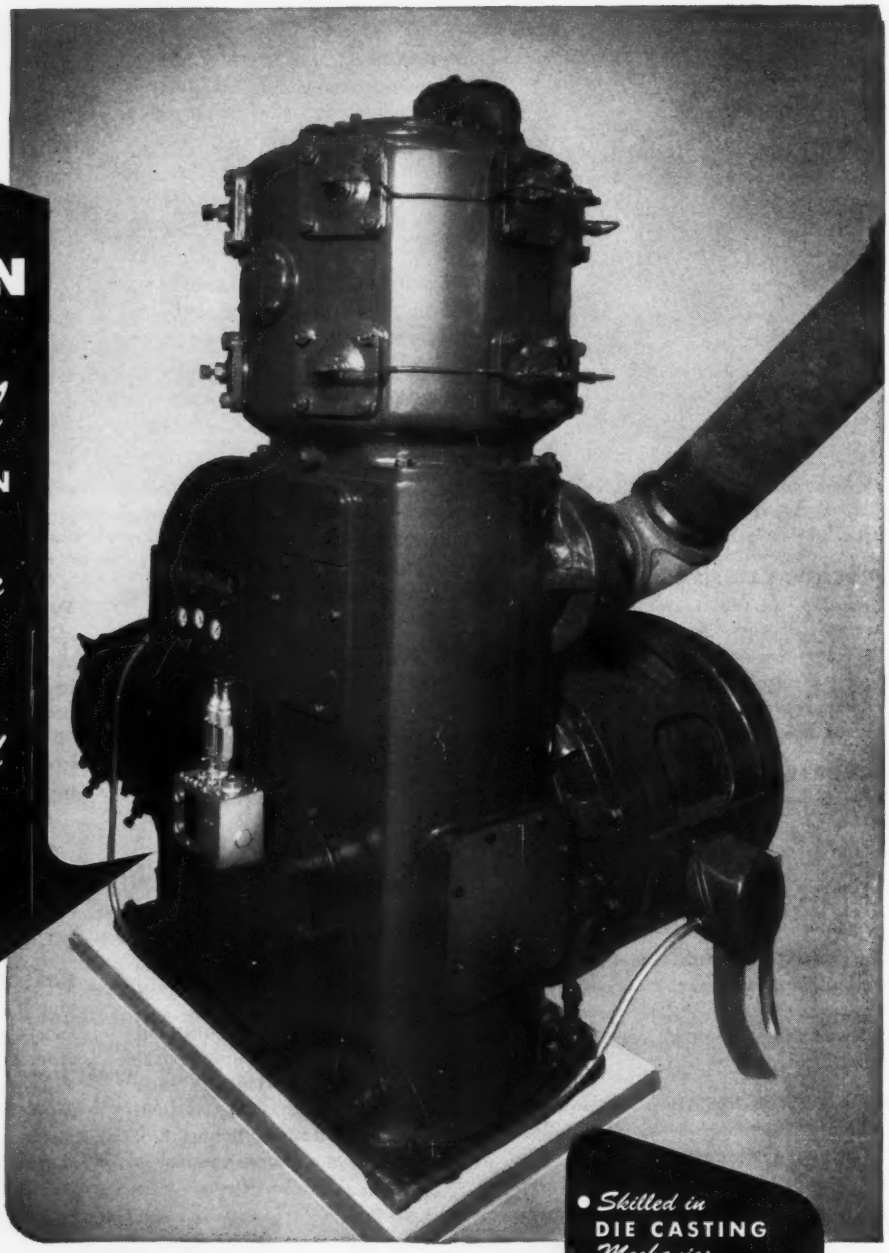

Illustrated, the Madison-Kipp Model SVH Lubricator on an Ingersoll-Rand XLE Compressor.

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Silicone Notes

ON LUBRICATION

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FILE SILICONE LUBRICANTS

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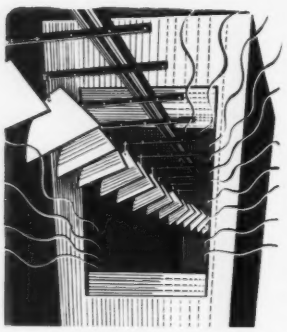
DOW CORNING CORPORATION
Midland, Michigan

DOW CORNING 41 GREASE

Bearings working at 375°F. in an oven conveyor system for baking the finish on electrical parts, failed frequently in spite of weekly relubrication. And many finished parts had to be rejected because of flaws caused by oil bleeding out of the bearings and dripping onto the uncured paint. Since using Dow Corning 41 Grease, bearing failure and rejects caused by melting grease have been eliminated, and the bearings have to be relubricated only twice a year.

After more than 30 months of service, conveyor bearings lubricated with Dow Corning 41 Grease are still running smoothly through an enamel drying oven operating at 300°F.



Bearing failures have been eliminated, maintenance and lubrication costs have been reduced to the vanishing point; production has been increased by at least the $100 worth of parts a day that were formerly rejected because the finish was spoiled by the dried-up, graphite-kerosene lubricant that fell down from the bearings.

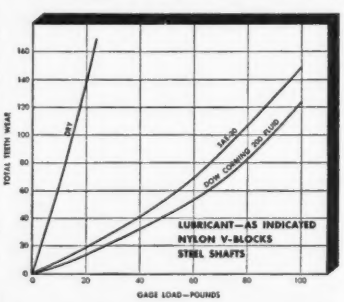
As an antiseize agent on the die threads of glass forming machines, Dow Corning 41 Grease makes it easy to take dies apart even after 6 months of operation at 340-380°F. Similarly, die assemblies used in molding phenolic closures formerly froze so tight that a welding torch was used to cut the dies and bolts apart. The same assemblies lubricated with Dow Corning 41 are easy to disassemble after long exposure to heat and steam. Hold-down bolts on rubber and plastic presses are also lubricated with Dow Corning 41 to prevent seizure.

DOW CORNING 200 FLUID

The ability to lubricate is a complex of so many variables that no absolute value can be given for any lubricant. Speed and load, bearing design and metal combinations, time and temperature all have a more marked effect on wear than the lubricant itself has. That fact has been very well demonstrated in the case of the silicone lubricants.

Take the Dow Corning 200 Fluids, for example. Our first experience indicated that these fluids had little, if any, potential value as lubricants. That seemed to be true in spite of the fact that they have all of the other properties required of an ideal lubricant. They show remarkable resistance to oxidation and to gumming for an indefinitely long period of time and at high temperatures. Volatility is very low and they have an exceptionally flat viscosity-temperature slope.

Further investigation showed that the Dow Corning 200 Fluids are, in fact, excellent lubricants under certain conditions. They are, for example, the best of all lubricants for plastic and fiber gears and bearings. In this case, and unlike most silicone lubricants, the Dow Corning 200 Fluids seem also to have better load carrying capacity as indicated by this graph based on Falex test results.



The superiority of these fluids as lubricants for nylon gears and bearings is further indicated by the fact that wear should be more exactly defined as deformation due to the heat of friction rather than loss of material due to wear.

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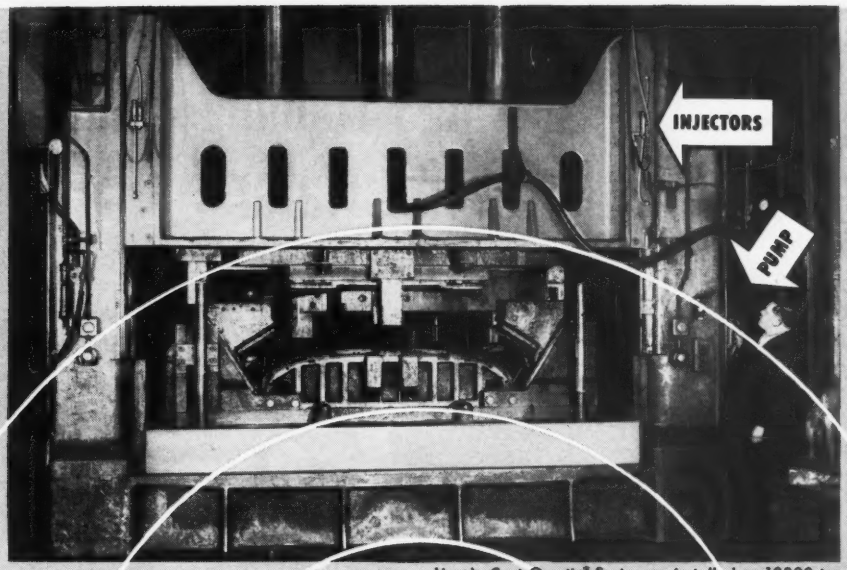

Lincoln CentrOmatic* System as installed on 10000-ton Hydraulic Press at Michigan Bumper Corp.

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SAVES PRODUCTION TIME... LOWERS MAINTENANCE COSTS"

C. R. Housdorfer, Vice Pres.
Michigan Bumper Corp., Grand Rapids, Michigan

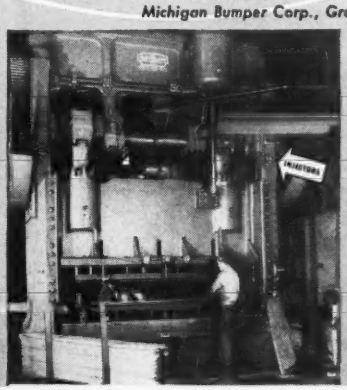
"We have been very pleased with our two Lincoln CentrOmatic Lubricating Systems as recently installed on our 525-ton Cleveland Mechanical press and our 1000-ton Lake Erie Engineering Corporation Hydraulic press.

"Applying the right lubricant in the right quantity at the right time has saved us considerable production time due to eliminating down-time for lubrication of ram and cushion ways. Lack of lubrication at these strategic points results in costly repairs and delays, especially in these times of shortages—as these ways are bronze. Savings in replacement and maintenance costs are naturally reduced in direct proportion.

"We expect to equip our other presses with Lincoln Centralized Lubricating Systems as soon as conditions permit."

C. R. Housdorfer, Vice Pres.
Michigan Bumper Corp., Grand Rapids, Michigan

525-ton Cleveland Press equipped with Lincoln CentrOmatic System.



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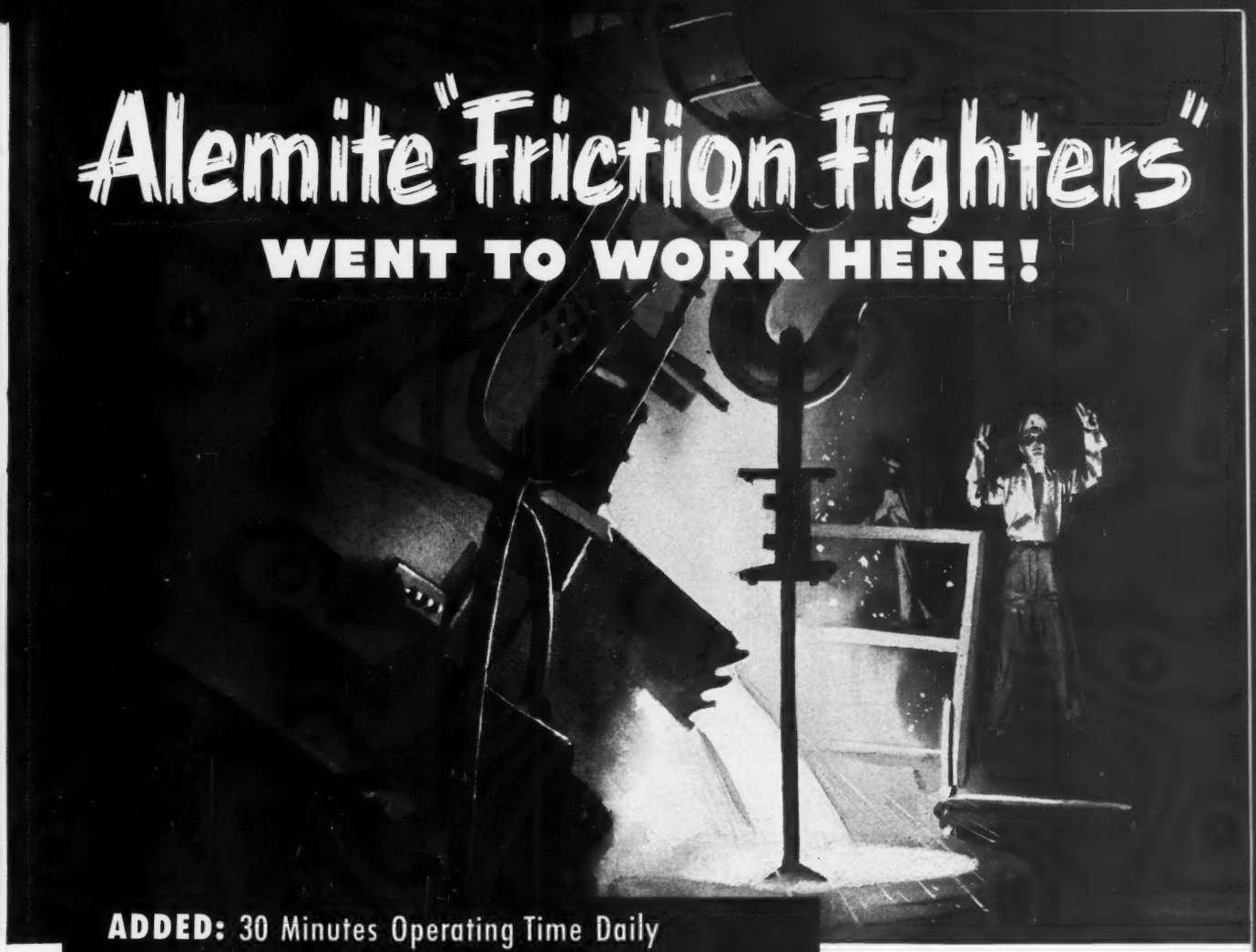

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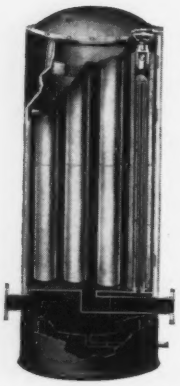

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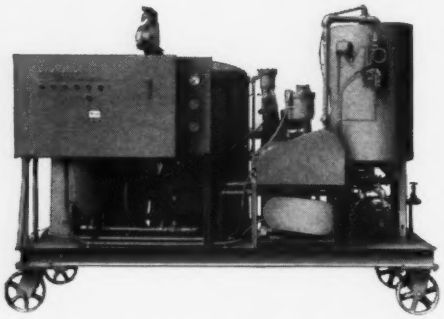
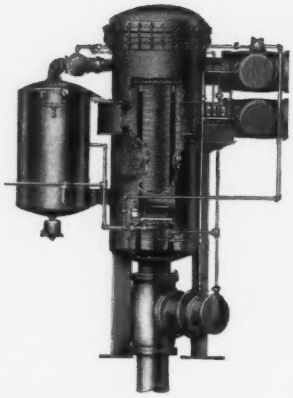


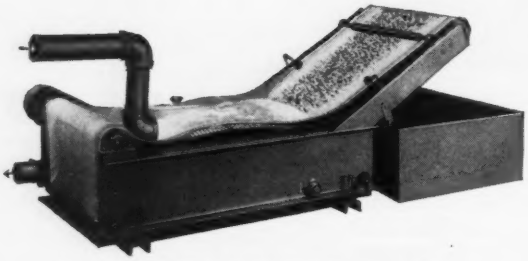
Houdaille "Purivac"

Compact, mobile unit purifies, dehydrates and degasifies insulating oil in one automatic operation . . . in the field (without taking transformers, circuit breakers or other electrical equipment out of service) . . . or at central station. Widely used to eliminate expensive transformer cleaning operations, reduce corrosion and deterioration of fabric insulation, restore dielectric strength of oil.



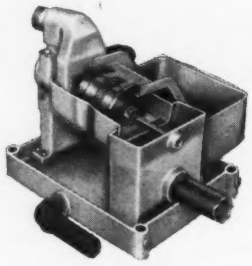
Houdaille Automatic Clarifier

For large central coolant systems. Removes chips, abrasives, dirt and other solid contamination from oils and coolants used in grinders, broaches, boring machines, milling machines, rolling mills and other metal working machine tools. Increases tool life, eliminates individual pumps and motors, allows better product finishes, extends coolant life, eliminates sump cleaning labor.



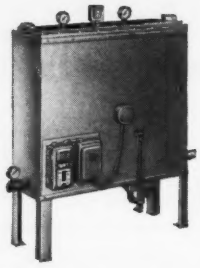
Houdaille "Web-O-Matic" Coolant Filter

Compact, automatic filtering unit utilizes continuously rotating filter belt that cleans itself, gives long, efficient service. Web-O-Matic removes all abrasive contamination, keeps coolant in safe, clean condition indefinitely. Handles large volume . . . individual units up to 400 gallons of soluble oil coolant per minute. (Volume and size of unit depending on viscosity of fluid.) Ideal for individual machine tools or for small central systems. Two types available: For applications requiring above-floor installation (illustrated); and for applications requiring bottom discharge below floor level.



Magnetic Filter

Small, compact and powerful. Ideal for installation on individual machine tools such as wet surface grinders, thread grinders, milling machines, gear shapers, drilling machines, etc. Takes up no more space than a drinking fountain, yet effectively removes abrasives and other coolant contamination.



Houdaille Water-Oil Separator

Removes water from turbine oils, hydraulic oils or any industrial oil where water contamination is a problem. Eliminates changing or discarding oil due to any type of contamination. Filters out solids, acids, oxidation products as well as water. Continuous, automatic operation.

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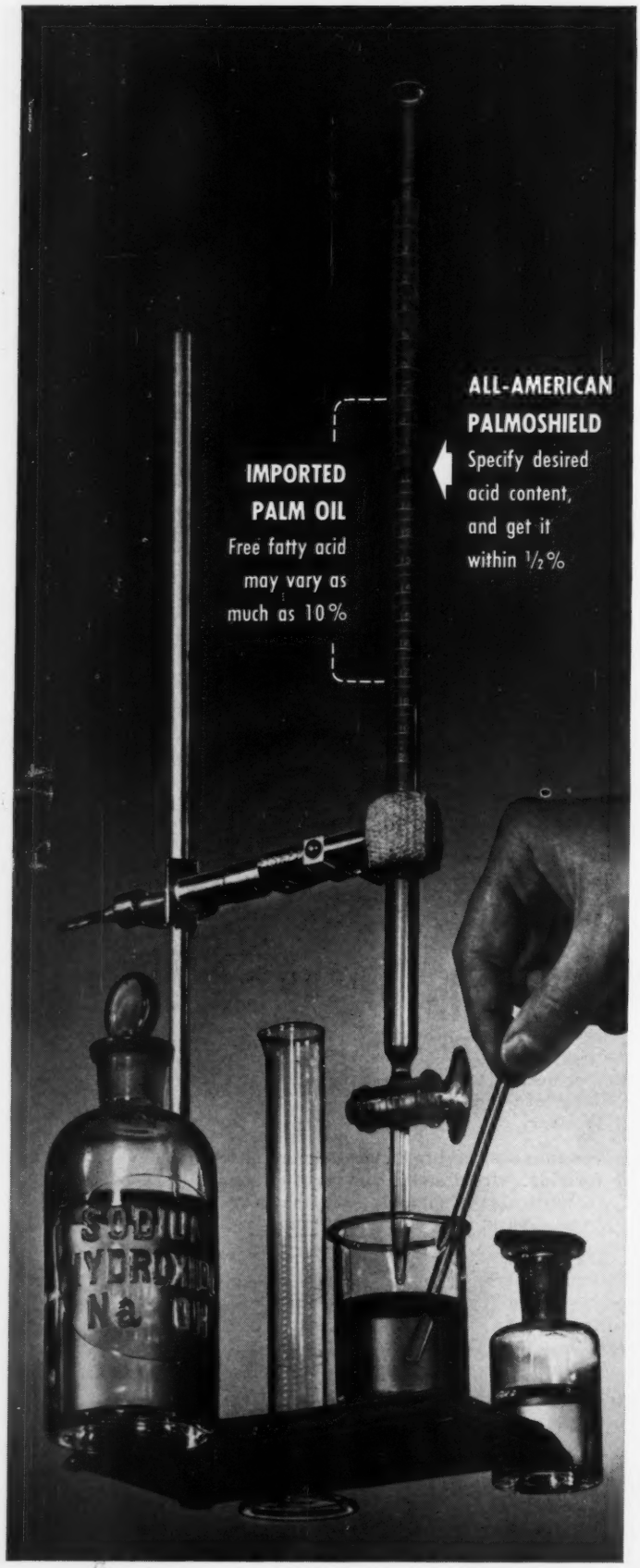

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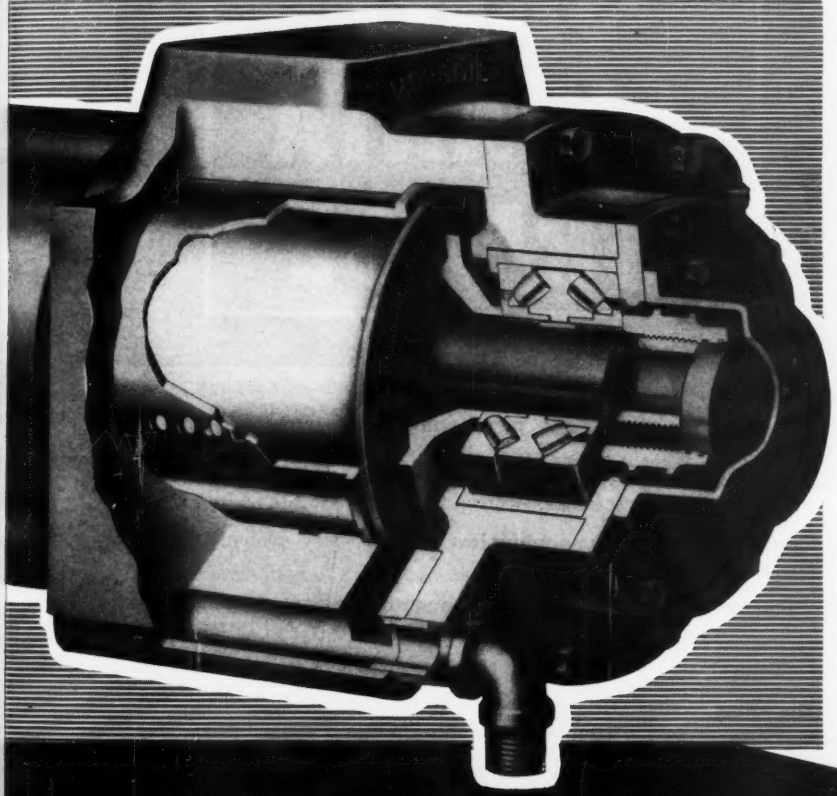

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Lube Lines

Summer Course at M.I.T.

To help meet the increasing need for formal instruction in lubrication engineering, the Massachusetts Institute of Technology announces a special two-week summer course to be held in Cambridge, Massachusetts, from June 23 to July 3, 1952. This program is designed primarily for the engineer responsible for lubrication scheduling and maintenance in an industrial plant, who has had general engineering training but no specific instruction in the field of lubrication. It is also intended for engineering students who are interested in taking advantage of the growing demand by industry for men trained in this field.

The course will cover all the basic and special information needed by a lubrication engineer in meeting his responsibilities in an industrial plant, including the following subjects:

Theory of hydrodynamic lubrication
Bearing design
Fundamentals of dry and boundary friction
Bearing materials
Fluid lubricants of all kinds
Non-fluid lubricants, especially greases
Lubricating systems
Lubrication of ball, roller, and needle bearings
Lubrication schedules for plants
Selection of lubricants
Organization of a lubrication section

The program will also include panel discussions on selected topics, such as oil reclaiming, hydraulic systems, and the lubrication of special types of equipment. Throughout the course, emphasis will be placed on recent developments and their practical applications. Lectures and discussions will be supplemented by laboratory demonstrations.

The course will be under the direction of Professor Brandon G. Rightmire, of the Mechanical Engineering Department, who is in charge of the M.I.T. Lubrication Laboratory. He will be assisted by members of the Institute's staff, and several of the lectures will be given by representatives from industry who are noted authorities in their respective fields, and who are well known to the readers of LUBRICATION ENGINEERING.

Since enrollment in the summer course will be definitely limited, early registration is advisable. The tuition for the two-week course will be $100.

M.I.T.'s dormitory, the Alfred Edgar Burton House, will be available for those participating in the program. Rooms for single men, as well as a limited number of accommodatons for married couples and single women, will be reserved if specifically requested in the application for admission to the course. The rate will be $3 per person per day, $18 per week, $28 per couple per week. Dining facilities on the campus will be open for all meals, and restaurants and hotels are located nearby. Summer guests are invited to use the Institute's libraries and recreational facilities which include tennis courts, the Alumni Swimming Pool, and the sailing pavilion on the Charles River.

Requests for further information and application blanks should be sent to Professor Ernest Huntress, Director of the Summer Session, Room 3-107 Massachusetts Institute of Technology, Cambridge 39, Massachusetts.

Lubrication Conference at Purdue

Purdue University, with the cooperation of the American Society of Lubrication Engineers, will hold an Industrial Lubrication Conference on the university campus at West Lafayette, Indiana, June 9 and 10, 1952. It is believed that this will be the only conference to be held in the midwest this summer.

A committee representing the ASLE has worked very closely with university officials in developing a program which is expected to bring a large number of lubrication engineers to the Purdue campus. The fact that Purdue has the largest undergraduate engineering school in the country is expected to be a further attraction.

Outstanding speakers representing industrial lubrication personnel, research personnel from petroleum companies, and university staff members have been invited to discuss such topics as "Management's Stake in Lubrication," "Physical Properties of Lubricants," "Methods of Testing Lubricants," "The Selection of Lubricants," "Case Problems in Determining the Lubricant to be Used," and "The Storage and Handling of Lubricants for Good Housekeeping."

There will be an evening session devoted to group discussions of specific lubrication problems. The program has been developed to appeal particularly to factory managers, plant superintendents, lubrication engineers, maintenance supervisors, and production personnel who are closely associated with maintenance problems.

Further information may be had by writing to M. M. McClure, Assistant Director, Division of Adult Education, Engineering Administration Building, Purdue University, Lafayette, Indiana.

Special Lubrication Session

A special session on plant lubrication, sponsored jointly by the American Society of Lubrication Engineers and the Production Engineering Division of the American Society of Mechanical Engineers, is to be a feature of the ASME Semi-Annual Meeting to be held June 16-19, 1952, in Cincinnati. C. L. Pope, past-president of ASLE, will speak on "Plant Lubrication Engineering," W. D. Whalen, vice-chairman of the Cincinnati Section of ASLE, will deliver a paper on "Modern Machine Tool Lubrication Practices" and C. E. Schmitz, ASLE president, will serve as chairman. ASLE members are invited to attend.

NUMBER 9

FILTRATION OF INDUSTRIAL AND LUBRICATING OILS

by John R. McCoy

Technical Service Director
Honan-Crane Corporation
Lebanon, Indiana

It is the intent of this paper to point out some of the needs for industrial oil filtration, the cause for such needs and the results which may be derived from proper filter application.

It is a well-known fact that mineral lubricating oils do not wear out but are rendered unfit for further service because of a very small percentage of contaminants which may enter the oil from the outside or which may form in the oil as the result of oil deterioration. The types of contaminants found in each operation will be discussed later when individual operations are discussed. It is not the purpose of modern filters to re-refine oils in service. Lubricating oils are being improved by new refining methods as time goes on and it is the responsibility of engine or machine operators to maintain these oils in as near a perfect condition as possible. This can be done only by proper filtration.

There are a large number of types of industrial engines, machines and operations which require oil filtration. Among these are internal combustion engines (gasoline, gas and diesel); hydraulically actuated machines of all types; all kinds of metal cutting machines such as screw machines, grinding machines, lapping and honing machines operating with both mineral and soluble oils; metal sheet and foil rolling operations on aluminum, tin, brass and copper; metal quenching; turbines (steam, hydro and gas); transformers and circuit breakers; industrial air filters; engine run-in operations; compressors; vacuum pumps and many others.

Continuous filtration is the most efficient and economical way to operate a filter. It is to be preferred over intermittent filtration or batch filtration because the contaminants can be removed from the oil as they are formed and this method allows the engine or machine to operate on clean oil at all times. Intermittent filtration or batch reclaiming allows clean oil operation only for a short time after the filtration or reclaiming operation but unless continuous filtration is employed the engine or machine will be operating on partially dirty oil a major portion of the time. An engine or machine which operates without the benefit of continuous filtration is continually subject to abrasive wear even though the oil is changed at frequent intervals. Frequent oil changes on engines without filters will greatly reduce wear but this changing of oil cannot be substituted for continuous filtration. By maintaining the oil in a good condition at all times the operator is assured the best lubrication without abrasive wear or acid action. THERE IS NO SUBSTITUTE FOR CLEAN OIL.

It is easier by continuous filtration to maintain an oil in a good condition than to reclaim it once it has become unfit for service. A much smaller filter is required to maintain the oil in good condition than is necessary to reclaim the same oil once it has become contaminated. Deterioration products act as catalysts to accelerate the formation of more such deterioration products. With proper filtration the rate of deterioration can be greatly reduced and the useful life of the oil greatly prolonged. It is recommended that filters be installed to operate on new oils in good condition rather than on badly deteriorated oil. It is not impossible but sometimes rather difficult to restore a badly contaminated oil to an acceptable condition with filters that are designed to maintain in-service oil in good condition. Many refill changes may be necessary before the oil is restored to a satisfactory condition.

Unfortunately it is not always economically feasible to filter oils on all types of operations on a continuous basis. Some operations have such high sediment loads that it is uneconomical to filter the oil without some method of pretreatment such as the use of chip wringers, centrifuges, settling tanks, etc. Because of the nature of other operations such as closed systems on transformers,

* Sponsored by ASLE Technical Committee on Lubrication Economics.

compressors, etc., it is not possible to filter the oil on a continuous basis. These oils by necessity must be batch purified.

Oils from different operations may contain a large variety of contaminants both soluble and insoluble. Soluble contaminants may include acids, soluble asphalttenes, partially burned fuels, etc. Insoluble contaminants may include blowby carbon, dust from the air, metal particles, metal cutting chips, abrasives from grinding wheels, core sand, lapping compound, lint, metallic oxides, sand, paint flakes, solid asphaltenes, scale, polishing rouge, gums, resins, etc.

Filters may be divided into many classes and types such as depth type, adsorbent, absorbent, bulk-type, inert, extended-area, edge-type, etc. Filters are usually designed for one or more specific purposes but none of them can be applied equally well to every application.

Depth-type filters require the oil to flow through a certain depth of filter medium. This depth will vary from approximately one inch to fourteen inches depending on the size of the filter. The sediment removed by such a filter will distribute itself throughout the depth of the filter medium. The filter cartridge will usually be in the form of a cylinder with an outlet tube in the center. The oil usually flows from the outside, through the filter medium and out the centertube. Depth-type filters may be either the throw-away cartridge type or bulk type. Adsorbent filters are usually of the depth-type. Depth-type filters may also be made of absorbent materials such as wool, jute, hair, cotton waste, wood cellulose or a combination of these.

Bulk-type filters (Figure 1) usually come equipped with baskets and centertubes. Bags for holding the filter medium, accessories such as centertube wrappings, gaskets, etc., and filter medium either adsorbent, or absorbent, may be purchased from the filter manufacturer and the operator can fabricate his own refills. Large bulk-type filters cannot be used where high flow rates are required. Where very high flow rates are desired, multiple cartridge-type filters are usually required. Where large quantities of filter medium are required, such as in the reclamation of transformer oil, it is usually more economical to use bulk-type units. Some of the large bulk-type filters may hold as much as 500 pounds of fuller's earth or 140 pounds of cellulose material. Because of the weights and sizes of the larger bulk-type refills, hoists are usually required to handle the spent refills. These hoists may be supplied with the filter unit if necessary.

Inert filters are designed solely for the purpose of removing insoluble contaminants. All filters except the adsorbent type may be considered inert. The design of the cartridge determines the flow rate and the size of the particles that can be removed. Adsorbent or active filters are usually recommended when soluble contaminants of a polar nature are to be removed. They will remove the most minute particles of abrasives as well as soluble contaminants. Adsorbent filters may employ the use of fuller's earth, bauxite, activated alumina or other adsorbents. Fuller's earth is by far the most commonly used adsorbent. Unfortunately adsorbent filters may also remove additives of a polar nature such as corrosion inhibitors and detergents. Adsorbent filters are generally

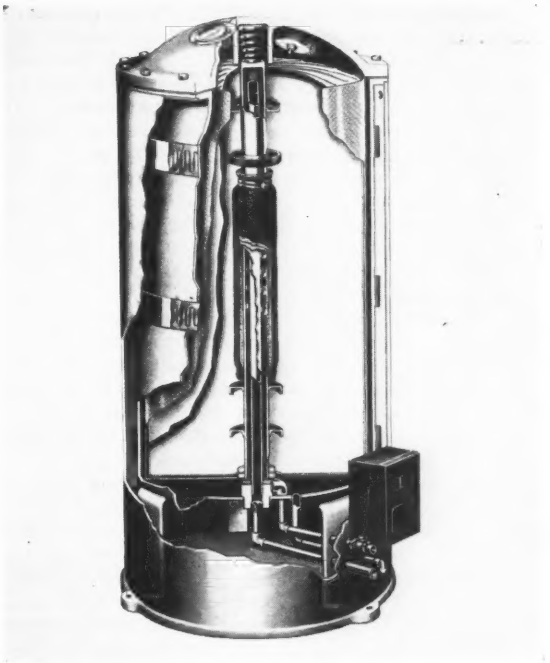

Fig. 1
Bulk-type filter.

not recommended for use with oils containing such polar inhibitors. Straight mineral oils contain no additives and with proper continuous filtration with fuller's earth type filters many such oils can be maintained in a near-new condition at all times and few if any oil changes will be necessary. A large number of industrial engines and applications use straight mineral oils and much benefit can be gained by the use of fuller's earth filters. Additives in oils will eventually be spent in operation and if their presence is necessary for the oil to perform its given function then the operators should set up periodic oil-change schedules.

Extended-area filters are usually constructed of paper in such a manner as to expose a very large surface of the paper. The amount of sediment that can be removed is dependent on the amount of surface area exposed and the porosity of the filter cake that is formed. Two popular filters of this type are made by folding sheets of resin-impregnated paper into "accordion pleats" or into "concertina folds" and forming the whole into cylinders. These filters can be used on a large variety of applications but the most common use is on automobiles, trucks, and tractors. Other types are made by stacking cellulose discs of various designs with alternate layers of cellulose spacers. Oil is filtered in one or more of three ways: laterally, vertically and/or between the discs in an edge-type manner. The design, density and manner of stacking the discs determines the flow rates obtainable, dirt capacity and particle size removal. Filter presses probably should be classified as extended-area filters. Filter presses are often coated with filter aids such as diatomaceous earth and when used in such a manner are called precoat filters.

Edge-type filters are usually constructed of metal or paper discs or specially constructed wire, wound on a cylinder. One metal edge-type filter is made by arranging stacks of metal discs and spacers in such a manner as to provide predetermined openings between the discs. Liquids to be filtered must pass between the discs and particles larger than the spaces between the discs cannot pass. The size of the spaces between the discs and hence the size of the particles that can be removed is determined by the thickness of the spacer. This type filter can be supplied with spacers ranging from 0.0035″ to 0.062″ and with flow rates on 20 SAE oil ranging from approximately 0.5 to 380 GPM. Wire-wound filters are constructed with predetermined spaces or slots between the wires. Spacings may range from 0.001″ to 0.020″. These cylinders may be constructed in various sizes up to 15 inches in diameter and several feet in length. Flow rates depend on the viscosity of the oil, size of the cylinder and spaces between the wires. Metal-edge type filters are usually constructed with the view in mind that they can be cleaned at intervals and used indefinitely. This may or may not be possible. Edge-type paper filters are constructed by stacking resin-impregnated paper rings or by helically winding resin-impregnated paper ribbon to form self-contained cylinders. These can be supplied in diameters ranging from one to six inches and in suitable lengths to fit the application.

Flotation units may be used for clarifying soluble-oil and water coolants. By this method a froth is created in the coolant and the solids are held in suspension by this froth and are skimmed off. Flow rates on systems of this type usually range from 20 to 1000 gallons per minute.

Magnetic filters make use of the principle of magnetism for removing metal particles. Their principle use is in the ferrous metal-working industry. Their efficiency depends upon the size of the particles to be removed and the viscosity of the liquid on which they are operated. Most magnetic filters use permanent-type magnets. They are quite popular for individual machine use where the contaminant load is so great that the use of cartridge-type filters is uneconomical. They are essentially automatic in operation and require a minimum of maintenance.

Centrifuges are often used as a means of removing water and sediment from oils. The efficiency of a centrifuge depends on the viscosity of the oil and the size of the particles to be removed. For insulating oils, flow rates range from 35 to 1200 GPH. Industrial centrifuges may develop centrifugal forces as high as 13,200 times the force of gravity. Among the more common uses are the removal of water and sediment from insulating, turbine, diesel and cutting oils and residual and crude oils. Heaters are often installed to reduce the viscosity of the oil or fuel. Centrifuges sometimes are installed to operate in conjunction with other industrial filtration equipment. They cannot remove soluble contaminants such as organic acids.

Most filters that are used for filtering mineral oils will be affected more or less by water. The filtration efficiency usually will be impaired and the flow rates usually will be reduced. If a filter becomes saturated thoroughly with oil before water reaches it, it usually will shed considerable amounts of water provided the flow rates, viscosities and pressures are not too high and the water is not too finely divided or emulsified.

More economical filtration can be effected by controlling or eliminating many of the contaminating sources from a lubricating system through proper design and operating control. Every precaution should be used in design and operation to minimize the entrance of contaminants such as water, dust, fuel dilution, and other foreign materials, and by proper application of improved seals, air filters, temperature controls, proper engine tune-up, etc. In other words, eliminate as far as possible the entry of contaminants into the lubricating system.

The ultimate in filtration would be a filter so designed as to give high flow rates at very low pressure drops; to have unlimited dirt capacity; and to remove all particles on one pass. Unfortunately no such filter exists and is not likely to exist. Any surface or depth filter that will remove dirt will become plugged and cause the flow rate to be reduced and the pressure drop to increase. Particle-size removal will more or less depend on the density of the filter and the higher the density the higher will be the pressure drop.

Internal Combustion Engines

There are three types of internal combustion engines in common use today, namely, gasoline, diesel and gas. Gas engines as a rule are the cleanest operating of the three types and diesels are the dirtiest. The lubricating oil may become contaminated in several ways. Road dust, abrasives, and other impurities may be taken in through the air intake and crankcase breathers. These abrasives mix with the oil and are circulated through the moving parts of the engine to cause abrasive wear to bearings, cylinder walls, piston rings, and other moving parts. Unburned and partially burned fuel, carbonaceous material, lead salts, and water enter the oil from the combustion chamber. Partially burned fuels are unstable and may be easily further oxidized to form gums and resins. The oil itself oxidizes to form soluble and insoluble contaminants. The water may combine with the carbonaceous material and insoluble oxidation products to form a thick, gummy sludge. Sludge may be circulated through the engine and cause oil filter screens to plug, piston rings to stick, valves and valve springs to gum up and oil ports to become plugged. Unburned fuel may dilute the oil and reduce its viscosity, thus decreasing its lubricating properties. If these contaminants are allowed to remain in the oil the efficiency and useful life of the engine will be greatly reduced and engine maintenance, operating costs, and downtime will be increased.

In the process of oil deterioration, oxygen of the air combines with the oil to eventually form acids and asphaltenes. These acids may attack bearings and other metal to cause corrosive wear and metallic soaps. The products of oxidation are, at first, soluble in the oil but as the deterioration process proceeds the oil may become saturated and the soluble asphaltenes may precipitate out as solids. Soluble oxidation products and partially burned fuels are usually responsible for varnish and lacquer deposits on hot engine surfaces. In general,

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the rate of deterioration of the oil is doubled for each 18 F. rise in temperature. Due to the oxidation characteristics of an oil and the effects caused by the oxidation products, oxidation and corrosion inhibitors and detergent-type additives are often added. In performing their functions these additives become spent and are no longer active. Oil additives cannot alter the need for proper oil filtration. Filters cannot replace additives which have been spent in service.

On slow-speed diesel and gas engines, straight mineral oils and fuller's earth filters have proved very satisfactory. Heavy-duty (detergent) type oils have generally been accepted for use in high-speed diesels and heavy-duty type engines for the most economical operation. For the filtration of detergent-type oils, inert-type filters are usually recommended. The appearance of a heavy-duty oil after a few hours service is not an indication of the condition of the oil. Most heavy-duty oils will become black after a few hours services but they will remain in a useable condition for many hours provided they are properly filtered. After many hours of use the filters may begin to clean the oil to a clear color again. This usually is an indication that the detergent is completely spent and is no longer active.

The amount of sediment that will occur in a lubricating oil system will depend on several factors (1) horsepower, (2) operating temperature, (3) type of fuel, (4) condition of the air cleaner, (5) intermittent or continuous operations (intermittent operation causes higher sediment accumulation than continuous operation), (6) percentage of power load, (7) condition of the engine, and (8) speed of the engine.

Factors which influence the selection of the type and size of the filter are engine horsepower rating, type of oil in service (straight mineral, premium or heavy duty), oil pressure, oil flow rate, operating viscosity of the oil, speed of the engine, type of fuel, condition of the engine and type of operation (intermittent or continuous).

There are four commonly used methods of installing oil filters on engines, (1) by-pass or bleeder, (2) full flow, (3) shunt, and (4) utilizing an auxiliary pump. Each method has its advantages and disadvantages and the engine manufacturer should be consulted as to the desired method of installation.

Field tests on engines operating with and without filters prove that considerable reduction in wear and maintenance can be effected by the proper use of filtration equipment. One automobile manufacturer reported that from 40 to 83 percent reduction in wear on his automobiles was effected by the use of oil filters. On an engine run-in stand it was found that it was necessary to discard the entire batch of 1400 gallons of oil every 2 to 3 days. After the installation of fuller's earth type filters the oil-change periods were extended to at least 30 days and rejects were cut by 50%. One large diesel engine manufacturer reported that lubricating oil filters decreased wear of the bearings by at least 80%. One company operates twenty-five 300 horsepower and eighteen 800 horsepower diesel engines which drive gas compressors on a 24-hour a day schedule of continuous operation. Operating data after the installation of fuller's earth type filters showed that oil changes have been eliminated and periods between engine overhauls have been extended from 5,000 hours to 10,000 hours or better of continuous operation. Engine oil filtration results in better lubrication, less wear and maintenance, more economical engine operation, extended engine life, extended oil life, less downtime and extended periods between overhaul.

Cutting Oils

There are a large number of metal working operations which require the use of cutting oils, both mineral and soluble. Among the most common are broaching; thread cutting on automatic screw machines and thread rollers; tapping and threading; gear cutting, shaping and shaving; drilling, boring and reaming; grinding, honing, and lapping and many others.

Cutting oils in these operations serve to provide lubrication and minimize surface friction; dissipate heat; prevent galling, rapid wear and seizure; prevent metal pick-up of tools and work; and to flush away chips as they are removed. Mineral cutting oils may be composed of a large variety of ingredients and may vary in viscosity from that of kerosene up to that of a light engine oil. High production has increased the amount of chips and other contaminants which enter this oil and hence the greater need for proper clarification. In machining operations as well as in engine operations, clean oils result in greater efficiency. The results which may be derived from clean cutting oils at the work are higher production, increased tool, wheel and oil life, less rejects, less downtime for sharpening tools, dressing wheels, etc., better finish, and better industrial hygiene.

The principal problem involved in the filtration of cutting oils is the removal of metal chips and shavings from the cutting operation. The types of chips vary from very large curly chips to very fine metal particles as small as 0.000039 inches in diameter. When removed by a filter some chips form hard cakes which are impervious to oil flow and some form soft, spongy cakes which cause little restriction to oil flow. Some chips are magnetic and some are not. Some are from heavy metals such as steel and some are from light metals such as aluminum and magnesium. These differences in character along with other factors such as the number of machines involved, plant layout, flow rate and types of oils, amounts of contaminants, and degree of clarification desired all influence the selection of a proper clarification system.

There are three types of clarification systems in common use today, namely individual-machine continuous systems, central-continuous systems and central-reclaiming systems. In large high-production plants, central-continuous systems are gaining in popularity. By this method the used oil is pumped into a collecting line through which it goes to a central-continuous clarification system and is returned to the many machines as clean oil. Some operations require individual-continuous filtration. On other operations the oil is used for one or more days and then taken to a central-reclaiming

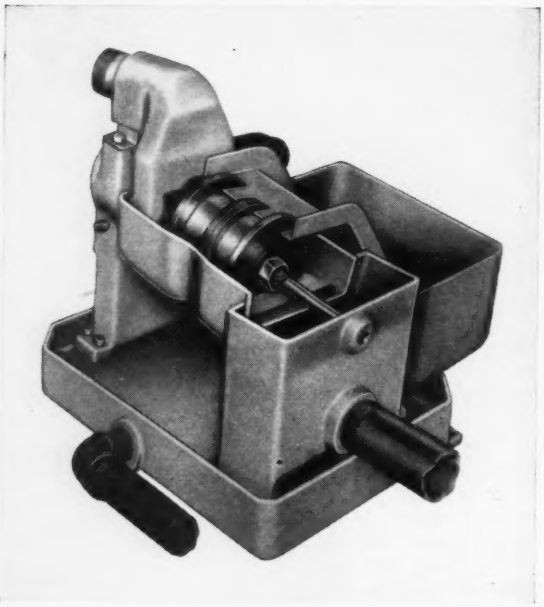

Fig. 2
Magnetic filter.

plant where it is reconditioned and returned for another run. If the chips are magnetic and are large enough and the oil is not too viscous, magnetic filters (Figure 2) should perform satisfactorily. These filters require very little maintenance. Where the chips are very fine, filters similar to those required on engines may be necessary.

On many types of operations the chips are of sufficient size and nature to be removed by metal-screen filters. Some of these are made fully automatic (Figure 3) so that they are self-cleaning and require very little maintenance. They are made in sufficient sizes to accommodate flows of several hundred gallons per minute. Conveyor systems can be so arranged that the chips will be automatically removed from the chip tanks and carried to trucks for disposal.

On some systems where automatic cleaning filters are not applicable and filters requiring replaceable filter cartridges are used, auxiliary methods of removing part of the sediment load may be required to reduce the cost of operation. Screened and baffled settling tanks, centrifuges and magnetic separators are often employed in addition to regular filters.

Probably the latest addition to the field of filters used in the filtration of cutting fluids is a rotating web filter (Figure 4). Fluids flow through the rotating web by gravity and solids are strained out in the process. The web is automatically cleaned of solids and used over and over again. Flow rates depend on the size of the filter, density of the web and viscosity of the oil. With soluble-oil coolants flow rates range from 40 to 400 GPM.

A large automobile manufacturer utilizes a completely automatic central system in the aluminum piston grinding department, utilizing three automatic, self-cleaning clarifiers to filter the soluble oil at 2500 GPM and continuous conveyers to remove the chips from the chip tanks. Advantages derived from this system are improved production, improved finish, improved wheel life, extension of coolant life from one day to more than six months, reduced down-time and improved general overall efficiency.

A manufacturer of electrical equipment operates a central system on 136 screw machines cutting both steel and brass. Eleven hundred fifty gallons of mineral oil is involved here. The oil is passed into settling tanks for a short retention time, then through a centrifuge and finally through depth-type filters. In addition to an increase in general overall production efficiency and increased tool and oil life there has been a marked reduction in industrial dermatitis.

On a thread-cutting operation using straight-mineral oil an automatic clarifier was installed. Oil flow of this machine was 180 GPM. In addition to better finished products, less rejects and longer tool and oil life, time studies revealed an increase in production of 27%.

On a steel thread-grinding operation the chip load was so great that it continually interfered with the machining operation. The flow of the mineral oil in this machine was only 20 GPM. Several types of filters were tried without success because of the high contaminant load. The installation was too small for automatic screen-type clarifiers. A magnetic filter working on a continuous basis solved the problem. The use of this filter has increased production, tool, wheel, and oil life and has improved product finish. Magnetic filtration of gear-shaver oil resulted in a 40% increase in tool life.

Quench Oils

Quenching of metals is a process whereby metals, heated to very high temperatures, usually 1500 F. to 1750 F. are dipped into a fluid, usually for the purpose of hardening the metals. There are several processes that can be used for this purpose but only mineral-oil quenching will be discussed here.

In quench operations it is particularly important that the oil be held at fairly constant temperatures. In

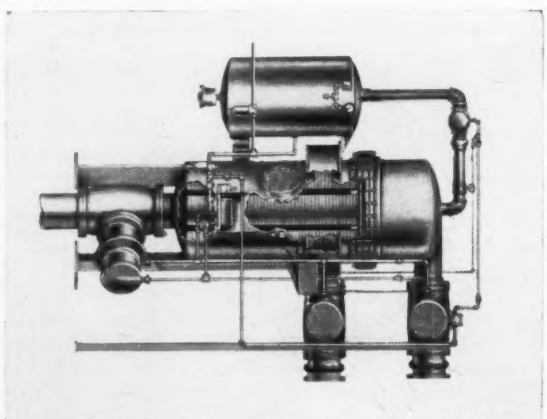

Fig. 3
Automatic screen-type clarifier.

the quenching process of dipping hot metals into the oil, the oil will increase in temperature. To offset this temperature increase coolers are usually installed. During quenching operations oils will oxidize and form asphaltenes. These asphaltenes will precipitate out of the oil on the cold surfaces of the coolers. After a time this coating may become so heavy that it will completely insulate the cooler tubes and render them inoperative. When this happens it may become necessary to shut down the whole system and clean the coolers. This is a dirty job and often requires a considerable amount of time. To prevent this fouling of the coolers, fuller's earth type filters are usually installed to remove these asphaltenes from the oil as they are formed. Inert filters will not remove soluble asphaltenes and acids; however, they may be very effective in removing scale, core sand, dust, etc.

A process which quenches rough metals such as plowshares and causes large amounts of scale and other contaminants to enter the oil is usually referred to as a rough quench. A process quenching highly machined parts such as gears, is usually referred to as a bright quench. Larger filters are usually necessary for the filtration of oils on rough quench operations because of the larger amounts of solid contaminants. Some of these operations are so dirty that conveyors are installed to remove the settled contamination from the bottom of the quench tanks.

A company which manufactures bearings operates three quench systems, each containing 600 gallons of oil. The three quench systems had to be shut down every four weeks for a complete cleaning of the coolers. Eighteen hundred gallons of oil had to be discarded and replaced with new oil. Much production time was lost. The installation of fuller's earth type purifiers completely eliminated the necessity of cleaning the coolers. The system was maintained in a clean condition at all times. Downtime for cleaning was eliminated and it was no longer necessary to change the oil. Maintenance costs were reduced enough in 10 months to completely pay for the filtration system.

Filtration of quench oils results in reduced downtime, eliminates oil changes, may improve actual quenching of the metal, reduces time of cleaning parts, reduces maintenance costs, allows close control of oil temperature, allows more uniform dissipation of heat in the quenching process, and improves the overall cleanliness and efficiency of the system.

Hydraulic Oils

In recent years hydraulically actuated machinery has taken its place in practically every type of industry that a person might think of. The reason for this is because it has many advantages over mechanical systems. Hydraulic systems are usually very simple, consisting of pumps, valves, pipe lines, hydraulic motors, oil reservoirs and, of course, oil. Along with many advantages gained with hydraulic systems there are certain disadvantages. Operating efficiency can be considerably reduced by rust, corrosion, high temperatures, dirt and products of oil deterioration. Hydraulic equipment is precision made and must be properly maintained to operate efficiently.

The results of an analysis of service calls by a large manufacturer of hydraulic equipment showed that 70% of these service calls were due to the improper condition of the hydraulic oil. This alone should be ample evidence that proper oil filtration on hydraulically actuated equipment is a "must." Fine abrasive particles cause wear to the precision-fitted parts and oil deterioration products such as asphaltenes and gums cause valves to become sluggish or completely inoperative.

Most hydraulic machines are equipped with strainers to take out the very large particles but these strainers usually are not efficient enough to remove the small particles which cause abrasive wear and products of oil oxidation and to maintain the oil in a satisfactory condition. Hydraulic oils do not become contaminated in the same sense as engine oils; nevertheless, unless they are properly maintained much trouble will result. Continuous filtration is the best way to maintain these oils in the best condition. Intermittent filtration has proved very successful, however, in many plants. By this method a filter is mounted on a dolly and moved from one machine to another. The filter is allowed to operate on the sump of one machine for several days and then it is transferred to another. The oil is filtered while the machine is in operation which eliminates any loss of time. The number of machines that one filter can service depends on the amount and condition of the oil involved and size of the filter.

The proper filtration of hydraulic oils prevents excessive wear of hydraulic parts, prevents clogging and sticking of control valves and pistons and extends oil life. Where straight mineral oils are used adsorbent-type purifiers have proved to be very satisfactory. They will remove all oil deterioration products as they are formed and prevent sluggish operation because of gums, etc. Inert filters are usually recommended on systems employing oils containing oxidation and corrosion inhibitors and will maintain these oils essentially free of all abrasives.

Fig. 4

Web filter.

Insulating Oils

In most industrial plants electricity is the chief source of power. In the process of providing this power many transformers are necessary. Most of these transformers contain a low viscosity oil ranging in quantity from a few to several thousand gallons each. A large part of the maintenance of transformers is in the proper care of the oil. Oil in a transformer serves two important functions, as an insulatng medium and as a heat transfer medium.

In the process of performing its given functions the oil gradually deteriorates by oxidation and picks up moisture. If the free moisture content gets above a certain level its insulating value is destroyed and arcing may result. If the oil deteriorates beyond a certain level asphaltenic material will precipitate out and deposit on the core and in the coolers of the transformer thus preventing the proper dissipation of heat. If this precipitation of asphaltenes continues long enough it may become necessary to remove the transformer from service, pull out the core and clean all surfaces manually. This is an expensive process both from the standpoint of labor and lost service of the transformer.

There are many thousands of gallons of transformer oil in service that should be reconditioned. Used oils may be reconditioned for a fraction of the cost of new oils. Some companies only filter oil through blotter presses to remove the water and insoluble contaminants. This will restore the oil to a high dielectric strength for the time being but because of its deteriorated condition, water may be absorbed more quickly and it may be necessary to repeat the process after a short period. The removal of water does not necessarily remove the sludging tendency of the oil. After an oil reaches the sludging stage it is necessary to remove the oxidation products.

By proper testing methods it is possible to determine at approximately what point an oil may begin to sludge. When it reaches this point it should be reconditioned. Reconditioning by adsorbent treatment is the process most commonly used and fuller's earth is the most commonly used adsorbent for this purpose. Large bulk-type purifiers are usually employed for this process. After treating the oil with an adsorbent it must be dehydrated in order to restore its dielectric strength. This may be accomplished by centrifuging, blotter pressing, or by passing the oil through a vacuum dehydrator. The current trend is toward vacuum dehydration.

There are several units on the market today which utilize a combination purifier and dehydrator of some kind. One such unit (Fig. 5) is composed of two large bulk-type purifiers mounted to operate in conjunction with a vacuum dehydrator and so equipped with safety devices that the oil in an energizing transformer may be reconditioned without removing the transformer from service. This is a distinct advantage because in some high production plants operating 24 hours a day, it is not always possible to de-energize transformers and stop production. This unit is made completely automatic so that no oil can be returned to the transformer until it has been safely dehydrated. In addition to dehydrating the oil the unit also deaerates it to remove air which causes oil deterioration.

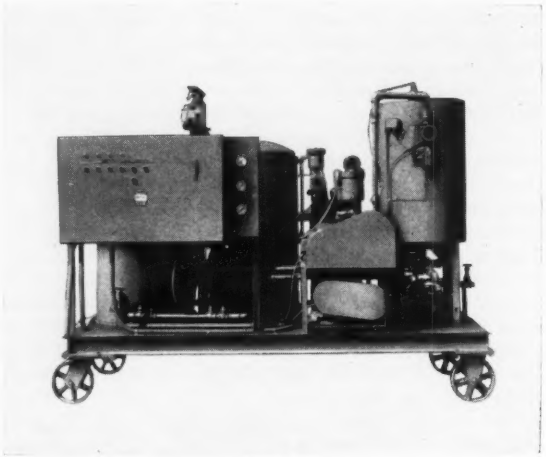

Fig. 5
Transformer oil reconditioner.

This unit is so constructed that it can be used in a central reclaiming plant or mounted on a truck or trailer and transported anywhere for operation in the field.

Synthetic Fluids and Lubricants

There has been an increasing interest in the last few years in synthetic fluids which may be used in the place of petroleum oils. Interest has increased because of some of the shortcomings of petroleum oils such as their inflammability and oxidation characteristics. Among the most popular synthetics are Aroclors (chlorinated diphenyls and chlorinated poly-phenyls), Dowtherms (orthrodichlorobenzene, diphenyl and diphenyl oxide), Lindol (tricresyl-phosphate), Silicones (organo-silicon polymers), Askarels (generic name of synthetic transformer oils), Ucons (polyalkylene glycol derivatives) and Hydrolubes (principally ethylene glycol, polymer thickeners and water). These fluids have varied uses such as heat transfer oils, air filter oils and lubricants for internal combustion engines, die-casting machines and aircraft-hydraulic mechanisms.

The same precautions must be used with synthetic fluids as are used with petroleum oils when the type of filter is selected. Some synthetic fluids may contain inhibitors which may be removed by active filters and in such cases inert filters should be used. Synthetic lubricants become contaminated with abrasives and breakdown products and should be filtered the same as any other lubricant.

Filtration equipment for synthetic fluids varies according to the liquid. Both inert and active-earth filters have proved very satisfactory. Fuller's earth type filters are being used very satisfactorily on Aroclors and Lindol and are recommended by the manufacturers. The Hydrolube fluids should be filtered through filters that will not upset the water-ethylene-glycol ratio. Fuller's earth filters cannot be used on Hydrolubes.

Some synthetic fluids attack normally used gaskets, pump packings and rubber hoses and therefore special materials must be provided for their use. Manufacturers of synthetic fluids can usually supply the names of such materials that are not affected by their product.

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LUBRICATION OF KNITTING MACHINERY*

by F. K. Fogleman
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Reading, Pa.

Mr. Fogleman received his B.S. degree in Mechanical Engineering in 1926 and his M.E. in 1930 from the North Carolina State College of Agriculture and Engineering.
He was associated with the Westinghouse Electric and Manufacturing Co. at South Philadelphia for two years in the capacity of Technical Apprentice and Assistant Technical Writer. In May of 1928 Mr. Fogleman assumed his present position as Technical Writer for Textile Machine Works.

The very nature of knitting machinery of various types is such that the problem of its proper, successful, and economical lubrication has changed but little over a period of many years. Lubrication does, however, play an extremely important part in the operation of this equipment. And while the problems have changed little, oils that will solve them have been developed and perfected by most lubricant suppliers.

Various specifications have been developed over the years that tend to insure the use of the proper lubricant for a specific purpose. Nevertheless, it is pertinent here to state that lubricants should not be bought on the strength of specifications alone; but also on the integrity and reputation of the supplier from whom they are purchased. Nor should it be necessary for the average knitting mill to stock more than two grades of machine oil and one grease in addition to a compounded or highly refined straight mineral oil for use on parts that come in contact with the fabric.

For many years it was the conventional belief, especially in the field of full-fashioned knitting, that as many as six different types of oil and a cup grease were essential to provide correct lubrication. This theory has been smashed, however, and aside from certain specific instances, specialty lubrication is out.

Generally speaking, knitting machinery of all types can be properly and economically lubricated by the use of four grades of lubricants:

1. Stainless Oil (compounded to provide ease in removal from fabric, commonly known as "Needle Oil," and used for lubrication of parts in contact with or close to the fabric. Its viscosity may be anywhere from 70 to 125 seconds Saybolt Universal at 100 degrees F.) A highly refined straight mineral oil with the same viscosity range can be used. Where it is used however, the color should not be darker than 1.5 max. (N. P. A.), to insure the prevention of goods spoilage.

2. A high grade light machine oil having a viscosity of from 180 to 305 seconds Saybolt Universal at 100 degrees F. For general lubrication, including cam mechanisms, bearings, spindles, Jack-Beds, and other parts normally lubricated through open oil holes.

3. A heavier grade of lubricating oil ranging in viscosity from 590 to 860 seconds Saybolt Universal at 100 degrees F. This is equivalent to an SAE 40 grade and is used for sight feed and wick type bearing oilers, as well as the Coulier gear and pinion on the full-fashioned knitting machine.

4. Either a semi-fluid lubricant consisting of 96% highly refined petroleum lubricating oil with a viscosity of from 300 to 750 seconds Saybolt Universal at 100 degrees F., and 4% sodium base soap; or a pure grade of non-fibrous soda soap grease with a melting point of from 300 to 500 degrees F., and free from acid or alkali, for use in antifriction bearings and miscellaneous gears or other parts requiring a sliding action.

Figure 1 illustrates the "Reading" Full-Fashioned Knitting Machine, and Figure 2 shows its frame and bearing construction, which can be considered typical of this type knitting machine. There are sixteen of these Center Frames over the length of the present 30-section machine, each of which carries ten main bearings. Seven of these bearings support oscillating shafts and three rotary. One of the three rotating shafts is mounted on double row radial type ball bearings requiring lubrication only once every six months. This is the Handwheel shaft with a maximum speed of 650 r.p.m. These bearings are used primarily to allow the knitter to turn the machine by hand without excessive strain. Tests have shown that once the machine is in operation there is very little difference in power consumption between machines with anti-friction and those with cast iron sleeve bearings for the Handwheel Shaft.

There are 156 main bearings on the frames, one

* Paper presented at 6th Annual Meeting, ASLE, Philadelphia, April 17, 1951.

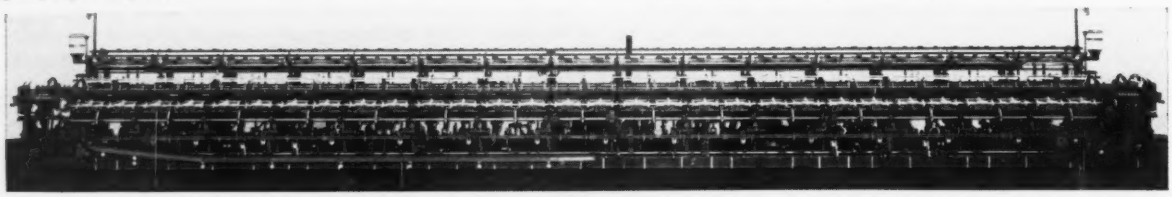

Fig. 1
The "Reading" High-Production Full-Fashioned Knitting Machine. 30 Sections. Length: 52' 9⅝" Weight: 16 tons.

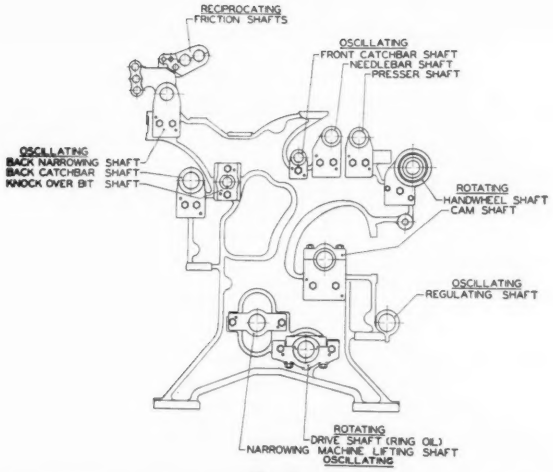

Fig. 2.
Frame and Bearing Construction of the "Reading" Knitting Machine.

set of 16 being fitted with porous bronze bushings and requiring lubrication once every four months; while another set of 12 are of the ring-oiling type.

The Needle Bar and Presser shaft bearings are of the typical cast iron sleeve type used predominantly on this machine. An oil groove is provided at the top of the bearing and since the shafts are oscillating, proper lubrication depends to a great extent on the capillary action of the oil flowing from the "X" groove. These shafts move through their cycle of a relatively small angle—in this case a maximum of 7 degrees—at a rate of from 12 to 80 per minute.

A heavier type bearing of the same construction is used to support the camshaft, which is a rotating shaft and carries approximately 2,200 pounds of cams that are subjected to extreme variations in load throughout the 360 degrees of rotation.

All of these bearings are lubricated satisfactorily by the use of a highly refined straight mineral oil having a viscosity of from 180 to 305 seconds Saybolt Universal at 100 degrees F. It is significant to note that the use of such oils containing oxidation and corrosion inhibitors, as well as possessing high film strength characteristics, is to be desired. Good metal wetting and stay-put characteristics are also invaluable. Because of the conditions of temperature and humidity under which they must provide adequate lubrication and protection, they are well worth the slightly higher price they command in the market.

In connection with the proper lubrication of the full-fashioned knitting machine within the past three years, design changes have been such that one of the outstanding problems has been that of properly lubricating the Sinker-Head and the Jack-Bed to prevent sinker breakage. Forward movement of the sinkers during a part of the loop-forming operations is controlled, in conjunction with the Jack-Bed, by means of the Slurcam Boxes, one at each section, fastened to the connecting bar. These cast iron slide boxes furnish the housing for the Slurcam, which, as it slides along the Slurcam Box Bar imparts the necessary movement to the Jacks and they in turn move the Sinkers forward successively. The slurring angle of the Slurcam is illustrated in Fig. 3, showing that the total amount of yarn for one loop is thrown by the Sinker before the succeeding Sinker comes in contact with the yarn. Here this angle is shown clearly. Because of the small clearance between the Sinkers, Dividers and Jacks in their respective slots (as little as .0005 in), the use of certain types of semi-fluid lubricants containing soap has given a great deal of trouble within the past three years. This has been caused by separation of oil and soap, thus leaving deposits of soap on the parts and resulting in Sinker-Head or Jack-Bed jams that often end in serious machine smashes. Such cases brought about the recommendation of a twister ring grease for this purpose where older machines are concerned. The one selected was of the soda-lime base type with a maximum soap content of 3%. At the present time, however, the design has been changed to such an extent that it is possible to use a high grade light machine oil having washability and non-staining characteristics. Here it is important that the Lubrication Engineer check the type of equipment against the manufacturer's recommendations or specifications before suggesting the use of a particular type oil for the purpose. Close tolerances between parts preclude the possibility of using soap-filler lubricants in this connection.

Figure 4 shows what appears to be an ordinary bevel gear and pinion which, under normal conditions, you would assume to operate satisfactorily over a long period of time, with very little attention from the lubrication angle. However, the nature of the machine is such that these gears take a tremendous beating, both from the stand-point of thrust against the teeth due to the shifting of the Camshaft for narrowing operations; and a change in pitch line contact due to excessive forward thrust on the Camshaft from the multiplicity of cams in action at various phases of shaft rotation. Experience has shown that the use of oil on these parts provides an increase in gear life of from 300 to 500%. Both the bevel gear and pinion and the massive mechanism that it must drive are lubricated by means of the light machine oil mentioned previously and the Coulier Cam receives its lubrication from the oil pan located directly underneath the cam. It is important that this cam be properly lubricated at all times to prevent wear and to insure uniform travel of the Slurcam Boxes and other

(*Continued on page* 101)

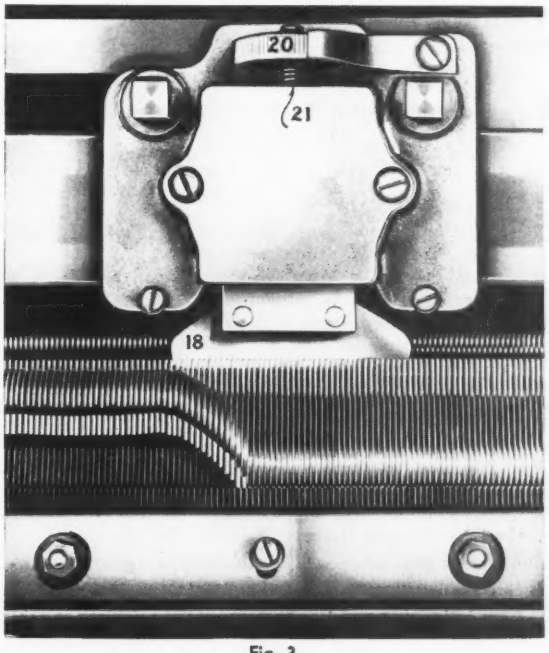

Fig. 3
Close-up of Slurcam Box and Slurcam action on the "Reading."

Program

Seventh Annual Meeting and Fifth Annual Exhibit

THE AMERICAN SOCIETY OF LUBRICATION ENGINEERS

Mon., Tues., and Wed., April 7-8-9, 1952

HOTEL STATLER -- CLEVELAND, OHIO

MONDAY, APRIL 7, 1952

9:00 A. M.—REGISTRATION—Ball Room Floor
Hotel Statler
Official Opening of Exhibits

Registration Fees: Members, $1.00; Non-Members, $3.00, of which $2.00 may be credited toward membership dues in the Society if application is made within thirty days after the Annual Meeting.

11:00 A. M.—GENERAL SOCIETY BUSINESS MEETING
OHIO ROOM

Chairman: N. I. Whiteley
President's Message—C. E. Schmitz
Treasurer's Report—O. L. Maag

12:30 P. M.—WELCOME LUNCHEON
EUCLID BALL ROOM

Speaker: Louis B. Seltzer, Editor of *The Cleveland Press*
Chairman: G. T. Collatz
Welcome to Cleveland by the Honorable Thomas A. Burke, Mayor of the City of Cleveland

2:15 P. M.—OPENING TECHNICAL SESSION
SESSION 1A
EUCLID BALL ROOM

Chairman: W. T. Everitt
"*Steel Mill Lubrication from Management's Point of View*"[2]—T. R. Moxley, Wheeling Steel Co.
"*What Lubrication of Coal Mining Machinery Means to Management*"[2]—C. W. Thompson, National Mines Corp.
"*Lubrication in the Chemical Industry*"—T. R. Witt, Tennessee Eastman Co.

SESSION 1B
PINE ROOM

Chairman: D. D. Fuller
"*New Horizons in Research*"—H. A. Leedy, Armour Research Foundation
"*A New Plan to Aid Independent Inventors*"—William Mendius, Sinclair Research Laboratories, Inc.
"*Lubrication Education*"—J. T. Burwell, Horizons, Inc.
"*Lubricant Research in the Department of Defense*"—E. L. Klein, Research and Development Board, Dept. of Defense

EXHIBITS OPEN TO 10:00 P. M.

TUESDAY, APRIL 8, 1952

7:30 A. M.—BREAKFAST for authors and chairmen
PARLOR C

9:00 A. M.—SESSION TWO
SESSION 2A
EUCLID BALL ROOM

Chairman: W. C. Kesler
"*Forum on Lubrication Economics*"[4]
SUBMIT QUESTIONS IN ADVANCE BY WRITING THE CHAIRMAN OR FROM THE FLOOR
Discussions
(1) "*As Related to Oil Reclamation*"—D. M. Cleaveland, Bendix Aviation Corp.
(2) "*As Related to Automatic Lubricating Devices*"—T. V. Picraux, Lincoln Engineering Co.
(3) "*As Related to Suppliers*"—C. R. Schmitt, E. F. Houghton & Co.
(4) "*From the User's Viewpoint*"—R. J. Torrens, Eastman Kodak Co.

SESSION 2B
OHIO ROOM

Chairman: E. A. Ryder
"*Turbo-Jet and Turbo-Prop Engine Lubrication*"—Lt. L. D. Christensen, Materials Laboratory, Wright Air Development Center
"*Physical and Chemical Properties of Aircraft Lubricating Oils As a Guide to Performance*"[3]—G. G. Lamb, Northwestern University
"*Oil Fog Lubrication*"—D. G. Faust, C. A. Norgren Co.

SESSION 2C
PINE ROOM

Chairman: J. Boyd
"*Symposium on Bearing Fatigue*"[5]
SUBMIT QUESTIONS IN ADVANCE BY WRITING THE CHAIRMAN OR FROM THE FLOOR
Discussions
"*What Is Bearing Fatigue*"—A. E. Roach and L. G. Johnson, Research Labs. Div., G. M. Corp.
"*Material Specifications for Oil Film Bearings*"—E. B. Etchels, Chevrolet Div., G. M. Corp.
"*Tired Bearings—Reasons and Remedies*"—J. Palsulich, Cleveland Graphite Bronze Co.
"*The Role of the Lubricant in Bearing Fatigue*"—E. S. Carmichael and R. B. Purdy, Socony Vacuum Oil Co., Inc.

EXHIBITS OPEN TO 6:00 P. M.

Program

TUESDAY, APRIL 8, 1952 (Continued)

2:15 P. M.—SESSION THREE

SESSION 3A

PINE ROOM

Chairman: L. H. Sudholz

"Cutting Fluids for Machine Tools"[7]—C. M. Larson, Sinclair Refining Co.

"The Disposal of Waste Oils"[6]—D. E. Bloodgood, Purdue University

"Prevention and Control of Industrial Wastes"[6]—P. W. Uhl, Detroit Diesel Div., G. M. Corp.

SESSION 3B

EUCLID BALL ROOM

Chairman: D. Morrell

"Hydraulic Forum—Progress Report JIC (Joint Industry Conference) Hydraulic Standards"[8]

SUBMIT QUESTIONS IN ADVANCE BY WRITING THE CHAIRMAN OR FROM THE FLOOR

Discussions

"Hydraulic Equipment Manufacturer's Viewpoint"—J. Robinson, Vickers, Inc.

"Machine Tool Builder's Viewpoint"—K. O. Tech, The Gross Co.

"Industrial Equipment User's Viewpoint"—A. McHugh, Ford Motor Co.

SESSION 3C

OHIO ROOM

Chairman: F. J. Sargent

"Fundamental Knowledge of Lubricating Grease Structure"[1]—B. W. Hotten, California Research Corp.

"Design Considerations for Optimum Performance of Silicone Greases in Ball Bearings"—G. Grant, Dow Corning Corp.

"Dispensing Characteristics of Lubricating Greases"[2]—R. F. Strohecker, The Texas Company

7:30 P. M.—ANNUAL BANQUET (Dress Informal)

EUCLID BALL ROOM

Toastmaster (to be announced)

Speaker: John R. Dunning, Dean of Engineering School, Columbia University

Introduction of New Officers

Presentation of Awards:
Alfred E. Hunt Memorial Medal
ASLE Honorary Life Membership Award
Walter D. Hodson, Jr. Award

WEDNESDAY, APRIL 9, 1952

7:30 A. M.—BREAKFAST for authors and chairman

PARLOR C

9:00 A. M.—PLANT INSPECTION TRIP—General Motors Cadillac Tank Plant, Cleveland, Ohio

9:00 A. M.—SESSION FOUR

SESSION 4A

OHIO ROOM

Chairman: A. J. Vreudenburg

"Symposium on Paper Machinery Lubrication"[9]

Discussions

"Lubrication of the Paper Machine"—A. E. May, The Moore and White Co.

"How to Keep Your Ball Bearings Rolling in Paper Mills"—John W. Samzelius, Westinghouse Elec. Corp.

EXHIBITS OPEN TO 6:00 P. M.

WEDNESDAY, APRIL 9, 1952 (Continued)

SESSION 4B

EUCLID BALL ROOM

Chairman: A. T. Colwell

"Evaluation of Lubricants for Computing Machines"—L. J. Hibbert and R. F. McKibben, National Cash Register Co.

"Lubricant and Cutting Oil Testing"[1]—R. J. S. Pigott, Gulf Research and Development Co.

"Global Grease Tests"—L. Mittleman, Tidewater Associated Oil Co., and B. Folda, General Petroleum Corp.

SESSION 4C

PINE ROOM

Chairman: F. C. Linn

"Minimum Oil Requirements for Ball Bearings"[5]—E. R. Booser and D. F. Wilcock, General Electric Co.

"Lubrication and Load Carrying Capacity of Gears"[1]—E. T. Hutt, Shell Refining and Marketing Co., Ltd.

2:15 P. M.—SESSION FIVE

SESSION 5A

EUCLID BALL ROOM

Chairman: R. I. Potter

"Selection and Application of Lubricants"—C. R. Schablitzke, McColl-Frontenac Oil Co., Ltd.

"Lubricant Classification"—C. A. Bailey, National Tube Co.

"Maintenance of Electric and Gasoline Driven Industrial Trucks"—A. E. Dorod, Baker-Raulang Co.

SESSION 5B

OHIO ROOM

Chairman: R. C. Adams

"What the Lubrication Engineer Can Do to Reduce Premature Gear Failures"—S. D. Craine, W. A. Jones Foundry & Machine Co.

"Application of Infrared Spectroscopy to Lubrication Engineering"—G. Rappaport, Materials Lab., Wright Air Development Center

"Seals and Closures"—E. W. Fisher, Garlock Packing Co.

SESSION 5C

PINE ROOM

Chairman: J. T. Walsh

"Studies of the Mechanism of Surface Damage by Fretting"[1]—D. Godfrey and E. E. Bisson, Lewis Flight Propulsion Labs.

"Carbide Steel Milling With Cutting Fluids"[7]—J. R. Roubik, Kearney and Trecker Corp.

"The Lubrication Properties of Molybdenum Disulfide"[1]—I-Ming Feng, Massachusetts Institute of Technology.

4:30 P. M.—BUSINESS MEETING OF OFFICERS AND DIRECTORS ASLE

EXHIBITS OPEN TO 6:00 P. M.

COMMITTEE SPONSORS

1 Technical Committee on Lubrication Fundamentals
2 Technical Committee on Lubrication Equipment
3 Technical Committee on Physical Properties of Lubricants
4 Technical Committee on Lubrication Economics
5 Technical Committee on Bearings and Bearing Lubrication
6 Technical Committee on Lubricant Reclamation and Disposal
7 Technical Committee on Fluids for Metal Working
8 Technical Committee on Hydraulics and Hydraulic Machinery
9 Industry Relations Committee

Abstracts ANNUAL MEETING PAPERS

The following abstracts of the papers to be presented at the 1952 ASLE Annual Meeting are published herewith for general information and to stimulate discussion at the meeting. They do not necessarily represent the final opinions of the authors and are subject to revision when the full papers are published.

WHAT LUBRICATION OF COAL MINING MACHINERY MEANS TO MANAGEMENT

BY C. W. THOMPSON
Manager, National Mines Corporation, Weirton
Mine Operating Office, Morgantown, W. Va.

The production of any mine depends on the continued operation of all machinery, and management realized that lubrication plays an important part in keeping this equipment in operation with the least number of breakdowns.

Much help in lubricating mine equipment properly can be derived by selecting an oil supplier that has a competent engineering staff. They have studied the various manufacturers' recommendations and have found by exhaustive study, by careful testing and actual application, that by selecting a small number of high quality products more efficient lubrication can be accomplished.

LUBRICATION IN THE CHEMICAL INDUSTRY

BY T. R. WITT
Division Maintenance Engineer, Tennessee Eastman Company, Division of Eastman Kodak Company, Kingsport, Tenn.

There was a time when lubrication was left more or less to the "oiler." For the past several years lubrication has been made a specialized field of maintenance and is now controlled from the purchase of the lubricant to the final application. The lubrication of the equipment is the responsibility of the division maintenance department and is performed by a group of lubrication men under the supervision of a lubrication foreman. This foreman is also responsible for preparing schedules, keeping all necessary records and training lubrication men. This is a more effective lubrication program and as a result lubrication costs have been sharply reduced.

A NEW PLAN TO AID INDEPENDENT INVENTORS

BY WILLIAM MENDIUS
Assistant to the Vice President, Sinclair Research Laboratories, Inc., Harvey, Ill.

Advance in science and technology have, in many cases, complicated the development of new ideas. Generally speaking, the individual inventor of today has neither the facilities nor the money to prove his ideas, particularly as concerns the oil industry.

The Sinclair Plan is a project to open up the facilities of a major research plant to work on the promising ideas of those independent inventors who have no such facilities available. By this action Sinclair hopes both to encourage the inventive spirit and to bring to light ideas of value to the inventor, the oil industry, and the public as a whole, which might otherwise go unnoticed or unused.

Sinclair has publicly invited inventors to submit any ideas pertaining to petroleum products providing these ideas are protected by at least a patent application. For those ideas which are accepted, Sinclair proposes a simple agreement specifying a mutually agreeable test program to be carried out by Sinclair. In return, Sinclair retains the right to use this invention on a royalty-free basis. The inventor retains sole ownership of his idea at all times.

LUBRICATION EDUCATION

BY J. T. BURWELL
Assistant to the Director of Research, Horizons, Inc., Cleveland, Ohio

Education in lubrication engineering is discussed in its two phases, the undergraduate and the professional refresher phase. Problems of the former stem from the fact that lubrication engineering is not yet known to, or recognized by, the majority of undergraduate engineering students today and they are reluctant to commit themselves to a specialty which they fear will lead to a dead end in the industrial company that they join.

Problems of the post-graduate professional refresher course stem from the diverse nature of the subject of lubrication engineering itself, namely that it encompasses parts of the fields of mechanical engineering, metallurgy, surface chemistry and organic chemistry. Engineers have been conventionally trained in the past in one of these fields and must now learn the other three in order to qualify as trained lubrication engineers. Examples of these problems are given from experience gained in both the student teaching and the 1951 Summer Course at M.I.T.

LUBRICANT RESEARCH IN THE DEPARTMENT OF DEFENSE

BY E. L. KLEIN
Executive Director, Panel on Lubricants, Committee on Fuels and Lubricants, Research and Development Board, Department of Defense, Washington, D. C.

This paper indicates the impact of the Department of Defense research and development program on the national lubrication picture.

The organization and functions of the Research and Development Board, and in particular its Committee on Fuels and Lubricants, are described and the relationship between the Board, the Committee, and the Military Departments defined. Some of the major weapon and equipment performance problems and the dependency of their solution upon lubricant, research and development are reviewed. Future military lubricant operational requirements are outlined. Means for solving these problems and meeting these requirements

through teamwork between industry and the military services are discussed.

TURBO-JET AND TURBO-PROP ENGINE LUBRICATION

BY LT. L. D. CHRISTENSEN
Chief, Oil Unit, Petroleum Products Branch, Materials Laboratory, Wright Air Development Center, Dayton, Ohio

Because of the inability of a single petroleum oil to perform satisfactorily at extreme high and low temperatures, a synthetic-base lubricant has been developed for use in the turbo-prop engine. The material is an excellent lubricant, is resistant to oxidation and thermal decomposition at temperatures in excess of plus 400 F., and provides for operation in the vicinity of minus 65 F. The lubricant consists essentially of a dibasic acid ester with additives to impart other desired properties. The finished fluid contains no extreme pressure additives because of their corrosive and sludge-forming action on certain metals.

Recent engine tests have shown that the lubricant is satisfactory in the power section of a turbo-prop unit. Further engine tests are currently being run to determine whether or not extreme pressure additives in the oil are necessary for satisfactory operation of the reduction gear box.

PHYSICAL AND CHEMICAL PROPERTIES OF AIRCRAFT LUBRICATING OILS AS A GUIDE TO PERFORMANCE

BY G. G. LAMB
Professor of Chemical Engineering, Northwestern University, Evanston, Ill.

Reciprocating aircraft engine requirements of high power output per cubic inch of engine displacement, high cylinder temperature operation, minimum weight, and maximum reliability demand and economically justify the best of premium quality lubricating oils. In view of the rapid development of compound or additive heavy duty type lubricating oils for diesel and automotive engines in the last ten years, why have not aviation lubricants led the field in these developments? A review of the fundamental physical and chemical properties of aircraft engine lubricating oils as delivered and as used; the effect of crude oil source and of petroleum subtractive refining methods such as dewaxing, deasphalting, and solvent extraction; and service operating records of aircraft engines shed some light on this matter.

OIL FOG LUBRICATION

BY D. G. FAUST
Chief Engineer, C. A. Norgren Co., Englewood, Colo.

Growing from infancy during the past 25 years, oil fog lubrication is today a vital and indispensable component of this country's industrial machine.

A great deal of research stands behind the present day micro-fog lubricators. It seems obvious that an understanding of the behavior of lubricating aerosols, particularly the waiting or lubricating characteristics, was essential if any great degree of progress was to be made in this field of lubrication.

Research into the behavior of lubricating aerosols was started in 1945. Progress was slow. New techniques and equipment were required to produce and analyze oil fog of extremely small particle size.

The purpose of this paper is to discuss some of the highlights of this research program, including a description of some of the techniques used along with pictures and diagrams of some of the apparatus developed for this purpose.

The utilization of oil fog lubrication is being extended daily. Applications previously considered impractical are now an accomplished fact. A discussion of some of these applications would seem to be of interest and value to all.

SYMPOSIUM ON BEARING FATIGUE

CHAIRMAN: J. BOYD
Research Laboratories, Westinghouse Electric Company, Pittsburgh, Pa.

(1) What Is Bearing Fatigue

BY A. E. ROACH and L. G. JOHNSON
Mechanical Engineering Dept., Research Laboratories Division, General Motors Corporation, Detroit, Mich.

The paper presents an analytical stress analysis of a two-layer bearing (such as babbitt overlay on a steel backing). The results of the analysis are interpreted in accordance with the distortion-energy theory. The effects of anisotropy of thermal expansion and of elastic properties are considered briefly.

(2) Material Specifications for Oil Film Bearings

BY E. B. ETCHELS
Design Engineer, Chevrolet Division, General Motors Corp., Detroit, Mich.

A paper describing the selection of metal compositions for various application in oil-film bearings, enumerating the factors and functional differences that influence the choice of available bearing materials in their use, some of which are in the final period of development.

(3) Tired Bearings—Reasons and Remedies

BY J. PALSULICH
Assistant Chief Engineer, The Cleveland Graphite Bronze Company, Cleveland, Ohio

This paper describes the composition and construction of sleeve bearings in common use. The effects of design and operating conditions upon fatigue are illustrated. The comparative resistance to fatigue of various bearing materials are shown in tabular form. Some not too well recognized types of fatigue are discussed. Erosion as a specialized form of bearing fatigue is described and remedies proposed for its elimination. Fatigue as an aftermath of lead corrosion in copper-lead bearings is illustrated.

(4) The Role of the Lubricant in Bearing Fatigue

BY E. S. CARMICHAEL and R. B. PURDY
Lubricants Section, Socony-Vacuum Oil Co., Inc., New York, N. Y.

Bearing fatigue failures, in general, are not influenced directly by the lubricant. However, by preventing excessive bearing temperature rises, by wearing-in or effecting highly polished surfaces, by protecting against corrosion and by sealing against contaminants, the lubricant may often play an indirect rule in minimizing metallic fatigue. This paper deals with the treatment of such factors in so far as bearing fatigue failures are concerned. Examples are cited, taken both from the literature and from actual field experience, to illustrate the effectiveness of the lubricant in this respect.

CUTTING FLUIDS FOR MACHINE TOOLS

BY C. M. LARSON
Chief Consulting Engineer, Sinclair Refining Company, New York, N. Y.

Metal cutting and shaping operations are influenced by the fluid used in the process.

The selection of cutting fluids or lubricants is gov-

erned by the machinability of the metal, cutting speed, cutting pressure, tool angle, machine operation (whether turning, boring, tapping, gear cutting, broaching or grinding), the finish desired on the completed parts and tool life.

The materials fabricated also influence a proper selection of fluid. Non-ferrous and ferrous metals and mild, heat treated or alloy steels each present their separate characteristics.

Grinding operations present their own peculiar problems and here also heat absorption may influence the final selection of fluid to a considerable degree.

Maximum production, prolonged tool life, minimum rejects and greatly lowered tool expense are assured by the selection of a proper cutting or grinding fluid.

Costs have been materially reduced in high production shops by the use of soluble oils for machining and grinding operations. The comparatively new EP type soluble oils are proving of great value in this direction.

To insure the retention of finish on machined parts during storage and between operations, rust and corrosion preventing qualities in cutting and grinding fluids, including the soluble type are required.

Finally we have the safety factor in storage and handling, the medical aspect of cleanliness and contamination in use to effectively minimize skin irritation.

THE DISPOSAL OF WASTE OILS

BY D. E. BLOODGOOD
Professor of Sanitary Engineering, Purdue University, Lafayette, Ind.

This paper points out that the extensive use of lubricating oils results in a tremendous quantity of spent oil that must be disposed of. The present methods of disposal, good and objectionable, are discussed at some length. The detrimental effects of oil on sewage treatment methods are described. A review of methods for the elimination of excessive wasting of usable lubricants is given. The present methods of oil water separation by floatation are presented, and their effectiveness discussed. The factors influencing the formations of emulsions are described. The chemical methods of breaking emulsions are presented and their effectiveness discussed. A brief presentation of the present research in determining the oil capacities of certain chemical flocs is presented.

PREVENTION AND CONTROL OF INDUSTRIAL WASTES

BY P. W. UHL
Chemist, Detroit Diesel Division, General Motors Corp., Detroit, Mich.

In the paper prepared on this subject, the author has purposely avoided involved technical details in order to present a common-sense approach to the problems involved.

Wastes are defined as to what constitutes industrial or true waste; their causes; effects; origin, and possible results in the way of public opinion, legal actions, and conservation of natural resources.

A number of typical wastes of the more common types are described with some detail as to their undesirability and general mechanics of treatment. A program of control and limitations is advocated by means of comprehensive specifications and efforts to reduce quantities of unwanted materials through technical control, as opposed to attack of the problem by wholesale methods of treatment after wastes have been created.

Possible uses of recovered products are mentioned while emphasis is placed upon the fact that industrial waste control programs in themselves seldom, if ever, offer indications of economical recovery of wastes but do prevent excessive pollution, while value of recovered products often reduces costs of treatment.

HYDRAULICS FORUM—PROGRESS REPORT JIC (JOINT INDUSTRY CONFERENCE) HYDRAULIC STANDARDS

CHAIRMAN: D. MORRELL
Supervisor, Fluids and Electrical Section, Manufacturing Engineering Office, Ford Motor Company, Detroit, Mich.

(1) Hydraulic Equipment Manufacturer's Viewpoint

BY J. ROBINSON
Chief Engineer, Vickers, Incorporated, Detroit, Mich.

From a manufacturer of hydraulic equipment's viewpoint, the adoption of the Joint Industry Conference Standards was based on sound engineering principles. There is no doubt that, although some of the hydraulic equipment manufacturers had initiated design change programs along the lines recommended by the JIC Standards, these conferences activated their efforts and introduced the thinking of the user of the equipment to these designs more than would have been possible without them.

If the nation in general and the engineering profession in particular were not operating under the stress of our national defense program, a much better comparison probably could be made between hydraulic equipment being used today and that being used in the period immediately following the last war. There is no doubt that the adoption of these Standards has imposed a heavy financial burden on most manufacturers, but fortunately the indications are that the selling price of hydraulic equipment has not increased with the improved articles; rather it is believed the price, in proportion to the inflationary tendency of all other commodities, is probably reduced. For this reason, the much felt scare of being forced to pay more to adopt these Standard has, from the equipment manufacturer's viewpoint, been refuted.

Whether or not service has been greatly affected will be discussed, although the general feeling is that as the adopted Standards are little more than three years old, service has not yet accumulated enough statistical evidence to be a worthwhile guide.

(2) Machine Tool Builder's Viewpoint

BY K. O. TECH
Chief Engineer, The Cross Company, Detroit, Mich.

This report will reflect:

1. The problems which existed prior to the development of the JIC Standards.
2. The methods used in utilizing the standards and the reconciling of the author's ideas with those expressed in the JIC Standards.
3. Accomplishments as a result of working with the JIC Standards. Typical of which was the redesigning of Way-Type Feed Units and Index Tables of the Fluid Drive Type.

(3) Industrial Equipment User's Viewpoint

BY A. McHUGH
Control Applications Engineer, Lincoln-Mercury Division, Ford Motor Company, Detroit, Mich.

The Joint Industry Conference (JIC) was originated by a machine-tool and equipment user group. Minimum performance standards were established rather than detailed standards. The primary reason for the JIC's existence is to eliminate excessive production downtime.

The JIC has been in existence for about six years and a great deal has been accomplished. Standards have been set up in various fields but at present we are concerned with the hydraulic standards and their effect on the design and construction of equipment being delivered to the user group.

The availability of the hydraulic components for maintenance can readily be seen when observing equipment built to JIC Standards. Valves and piping are accessible. Hydraulic oil reservoirs are separated from lubrication reservoirs to prevent lubricating oil contaminants from getting into the hydraulic system.

Maintenance of the hydraulic circuit is made easier because of the circuit diagram sent with the equipment. The symbols are standard on all drawings, to avoid confusion. The various manufacturers use the same symbols for their hydraulic diagrams.

Ford Motor Company has been receiving hydraulic cylinders with hardened rods. There has been less scoring and nicking of rods; therefore the leakage at the rod end has decreased accordingly.

Since the Ford Motor Company has adopted the JIC standards there has been a definite improvement in the production equipment. The down time is less because of availability of the hydraulic components and improved circuit design.

FUNDAMENTAL KNOWLEDGE OF LUBRICATING GREASE STRUCTURE

BY B. W. HOTTEN
Research Chemist, California Research Corporation, Richmond, Cal.

The composition and functional requirements of greases are briefly described. Theories of the physical structure of greases are discussed and recent evidence in favor of the microcrystalline paste theory is presented in detail. The variation of fiber structure with thickener composition is shown in electron micrographs. Changes in structure with temperature are described. Finally the relation between collodial structure and flow properties is described. Correlations between structural and functional properties of lubricating greases are pointed out wherever applicable.

DESIGN CONSIDERATIONS FOR OPTIMUM PERFORMANCE OF SILICONE GREASES IN BALL BEARINGS

BY G. GRANT
Manager, Motor Test Laboratory, Dow Corning Corp., Midland, Mich.

It has been noted that, in certain high-temperature life testing of ball bearings, a wide dispersion of end points was obtained under test conditions that were supposed to be identical. This wide variation was found primarily in bearings lubricated with silicone greases and not in bearings packed with organic greases. Further investigation indicates that the life of silicone lubricated bearings in totally enclosed, non-ventilated motors is a function of the mechanical fit-up of the bearing assembly as well as the heat-stability of the grease. This leads to certain recommendations designed to reduce or eliminate premature failure in sillicone lubricated bearings.

DISPENSING CHARACTERISTICS OF LUBRICATING GREASES

BY R. F. STROHECKER
Mechanical Engineer, Beacon Laboratories, The Texas Co., Beacon, N. Y.

The primary object of this work was the development of relative dispensing data on commercial greases having different soap bases and mineral oil contents, with the secondary object being to relate the foregoing data to a laboratory testing device to facilitate the determination of the relative pumpability characteristics of greases.

The paper describes the work done in testing thirty greases, over a temperature range, in air-operated service-station-type pumps to determine the dispensing characterestics of the greases. The relationship of the laboratory restrictions used to actual vehicle shackles and fittings is presented, with the development of suitable failing conditions to interpret the test data. The various factors affecting pumpability are also discussed.

The development of a method relating failing temperatures determined from actual pumping tests to failing temperatures as determined from ASTM Pressure Viscosimeter data is presented, and shown to be satisfactory with a high degree of accuracy.

SYMPOSIUM ON PAPER MACHINERY LUBRICATION

CHAIRMAN: A. J. VREUDENBURG
Plant Engineer, Paterson Parchment Paper Company, Bristol, Pa.

(1) Lubrication of the Paper Machine

BY A. E. MAY
Assistant Chief Engineer, The Moore & White Company, Philadelphia, Pa.

The lubrication of the paper machine presents many problems because of the wide range of operating conditions. Parts of the machine are subject to low temperatures and running water, and other parts are subject to high temperatures, dust, and excessive moisture. Loads on bearings vary from light to very heavy.

All of the above conditions must be taken into consideration in the selection of lubricants.

Improperly lubricated dryer bearings are the cause of many time-consuming shutdowns. Typical designs of plain and antifriction dryer bearings are discussed. The unsatisfactory operation of a dryer bearing caused by the improper lubricant is discussed in detail.

Fretting corrosion is not recognized as a distinct type of corrosion by a great many paper mill operating men; and because of this preventive measures are given.

The specification of the type of bearings for a wide, high speed machine is not difficult, but the choice of bearings for the slower and narrow machine is more difficult.

The results of a survey of machines built by the more important builders in recent years is given.

(2) How to Keep Your Ball Bearings Rolling in Paper Mills

BY JOHN W. SAMZELIUS
Mechanical Engineer, Westinghouse Electric Corporation, Motor and Control Division, Buffalo, N. Y.

This paper deals with the latest recommended methods for the lubrication and care of anti-friction bearings in electric motors. In addition, the interpretation of customary danger signals from distressed bearings is discussed in detail. This paper should be of great practical value of those charged with the actual maintenance work.

EVALUATION OF LUBRICANTS FOR COMPUTING MACHINES

BY L. J. HIBBERT and R. F. McKIBBEN
Finishes Laboratory, National Cash Register Company, Dayton, Ohio

Computing machines are subjected to a wide variety of conditions, requiring a unique combination of characteristics in the lubricant to provide suitable operation of machines under all conditions. Methods of determining these various characteristics in the laboratory and

their relative effect on operation of machines in product operation tests and in field service are described.

LUBRICANT AND CUTTING OIL TESTING

BY R. J. S. PIGOTT
Director of Engineering, Gulf Research and Development Company, Pittsburgh, Pa.

"Lubricant and Cutting Oil Testing" will contain a discussion of some of the new equipment for evaluating oils and greases for bearings, and the action on piston rings; likewise a discussion on the new method of applying cutting oil which produces very large increase in cutting life.

Some of the instruments discussed would be a piston ring scuff-test machine, a new high speed gear testing machine, a new bearing test machine for all types of loading, new instruments for measuring forces and temperatures in metal cutting, both on lathe work and drilling, and a discussion in some detail of the principles and method of applying cutting fluids to the tool and work.

MINIMUM OIL REQUIREMENTS FOR BALL BEARINGS

BY E. R. BOOSER and D. F. WILCOCK
Bearing and Lubrication Center, General Electric Co., West Lynn, Mass.

A study has been made of the running time of ball bearings operating with minute quantities of lubricating oil. The relations obtained indicate that medium size ball bearings can run for years on one drop of oil at moderate loads and speeds. Data are presented for various bearings, speeds, loads, and types of lubricants. Some correlation is obtained with life of greased ball bearings, and the results are also believed to be of utility in studying ball bearing construction, mist lubrication, and general ball bearing operation.

LUBRICATION AND LOAD CARRYING CAPACITY OF GEARS

BY E. T. HUTT
Research Engineer, Thornton Research Center, Shell Refining and Marketing Company, Ltd., England

A large share of the world's power passes, at some stage, through the bottle-neck of a gear-tooth contact. The problem of calculating and as far as possible increasing the power-transmitting ability (or load-carrying capacity) of gears is therefore one of prime importance to engineers. The calculation of load-carrying capacity is not difficult if we think of it as limited only by the risk of tooth fracture, since gear teeth are machine elements and subject to the well-understood laws of mechanics. But the oil film separating the teeth is a machine element, too, though seldom thought of as such, and gears can fail otherwise than by tooth fracture in ways which can be influenced by the character of the oil and its interaction with the conditions under which it is used. The functions of the oil supply are therefore reviewed in relation to the recognized types of gear failure and the oil shown to be much more than a mere "lubricant" in the ordinary sense of the world. The ways in which operating conditions and choice of lubricating oil can influence the scoring and pitting of gears in service are considered and some research findings concerning the influence of oil viscosity and other physical properties, supply temperature, flow rate, method of application, and the like are presented and discussed.

Can we predict gear- and gear-oil performance from such data? Not yet, but a survey of the present position and recent contributions in this field afford hope that this may one day be a practical possibility. The problem is still far from a satisfactory solution, however.

SELECTION AND APPLICATION OF LUBRICANTS

BY C. R. SCHABLITZKE
Assistant Division Manager, Industrial Sales, McColl-Frontenac Oil Co., Ltd., Yardley House, Toronto, Ont., Canada

The author presents his observations on lubrcation practices in many different types of industry based on experience in the United States and Canada. The importance of effecting a better understanding among equipment manufacturers, lubricant manufacturers and the plant lubrication engineer is stressed, particularly with regard to the selection of lubricants solely on a specification basis. The many factors entering into the selection of the proper type lubricant for any specified application are reviewed. The monetary savings possible through the proper emphasis in plants on the selection and application of lubricants are illustrated.

LUBRICANT CLASSIFICATION

BY C. A. BAILEY
Lubrication Engineer, National Tube Co., Pittsburgh, Pa.

A discussion of the problems encountered in the identification of lubricants as purchased under brand names or specifications. The adaptation of a code system similar to the SAE numbers for motor oils but applying to all industrial lubricants. The assigned number is individual to the brand name product and is correlated to a purchasing statistics code so that the entire mechanics of the system is handled by IBM tabulation machines.

MAINTENANCE OF ELECTRIC AND GASOLINE DRIVEN INDUSTRIAL TRUCKS

BY A. E. DOROD
Engineering Consultant, Baker Industrial Trucks Division, Baker-Raulang Company, Cleveland, Ohio

Some basic fundamentals apply to the lubrication of most mechanical equipment, and the industrial truck is no exception.

A few of the more pertinent facts are these:

1st Use the right lubricant in the right place at the right time. Follow the manufacturer's recommendations as to what, where and when.

2nd Avoidance of overlubrication.
Overlubrication is as bad as underlubrication.

3rd Complete and thorough lubrication.
Force out all of the dirty lubricant by the entrance of clean lubricant.

4th Lubricant cost versus repair costs.
Even the most expensive lubricants and equipment is far cheaper than repair parts.

5th Contaminated lubricants.
Never use lubricants that have been exposed to dust or dirt.

Summing up the whole situation, it is a well-known fact that wear cannot occur so long as parts are separated by an adequate film of lubricant.

WHAT THE LUBRICATION ENGINEER CAN DO TO REDUCE PREMATURE GEAR FAILURES

BY S. D. CRAINE
W. A. Jones Foundry and Machine Co., Chicago, Ill.

The majority of premature gear failures can be prevented by proper evaluations of periodic gear inspections. The position of the Lubrication Engineer is unique in that he comes in frequent contact with every gear train in the plant. As director of the lubrication program he is the logical man to direct the preventive maintenance of gears. To fulfill this latter responsibility

adequately he must be familiar with the initial indications of the factors affecting improper gear operation. This paper will cover the early indications of the following contributory factors:

1. Misalignment, vibration and undue shock
2. Improper lubricant, characteristic and type
3. Improper metallurgy and treatment
4. Improper gear, bearing and housing design
5 Improper loading, both initial and final.

APPLICATION OF INFRARED SPECTROSCOPY TO LUBRICATION ENGINEERING

BY G. RAPPAPORT
Physicist, Physics Branch, Materials Laboratory,
USAF Wright Air Development Center, Dayton, Ohio

For the past three years infrared spectroscopy has been applied in the author's laboratory to the identification of lubricants and their components. Information gained through this work is illustrative not only of the applicability of infrared spectroscopy to the compositional analysis of lubricants but also of the reasons for the interest of the Air Force in the identification of lubricants. Specific analyses are cited involving greases, antiwear additives, and other components of modern lubricants. Punchcard system utilized by the author for the filing and sorting of infrared data is described and its importance in analysis is stressed. The ability of the infrered technique that allows identification of chemically ill-defined compounds is emphasized.

SEALS AND CLOSURES

BY E. W. FISHER
Garlock Packing Company, Palmyra, N. Y.

This paper considers the complete range of bearing sealing devices from the simple mechanical clearance, labyrinths and felts up through spring-loaded seals of both the radial and axial type. The scope of the paper precludes detailed study of any one seal, but the over-all pattern establishes a reasonable foundation for further study of specific installations.

Brief comment is given concerning the main features of construction which are clearly presented through the use of a large number of slides. The advantages and disadvantages of various types of sealing materials are considered. Enough theory tempered with practical experience is given to assist in making less difficult the proper choice of a seal or closure.

STUDIES OF THE MECHANISM OF SURFACE DAMAGE BY FRETTING

BY D. GODFREY and E. E. BISSON
Lubrication and Wear Section, NACA Lewis Flight
Propulsion Laboratories, Cleveland, Ohio

The background of research on fretting (fretting corrosion or friction oxidation) shows that additional information is required. In accordance, an experimental investigation of the basic mechanism of damage to surfaces by fretting was conducted by NACA, utilizing the technique of microscopic observation of the action. Glass and other non-corrosive materials, as well as metals, were used as specimens. A simple apparatus vibrated a convex surface in contact with a stationary flat surface at frequencies of ½ to 120 cycles per second, an amplitude of 0.001 inch and a load of 0.2 pound.

The observations and analyses lead to the conclusions that fretting is caused by the removal of finely divided and apparently virgin material due to inherent adhesive forces between the surfaces. The fretting of non-corrosive materials indicates that oxidation is a secondary rather than a primary factor.

Studies of methods of inhibition of fretting indicate that MoS_2 can be quite effective in delaying the start of fretting if the coating of MoS_2 is properly applied. MoS_2 is particularly effective because of its capability of reducing metallic adhesion at the surfaces (resulting in low friction coefficient) and because of its tenacity for steel.

CARBIDE STEEL MILLING WITH CUTTING FLUIDS

BY J. R. ROUBIK
Research Engineer, Kearney-Trecker Corporation,
Milwaukee, Wis.

Tool life tests of carbide face-milling with cutting fluids on several different kinds of steel at hardnesses of approximately 200, 300, and 400 Bhn are reported. Blade wear and tool life results obtained with cutting fluids are compared with results obtained cutting dry. Horsepower requirements are also given.

THE LUBRICATION PROPERTIES OF MOLYBDENUM DISULFIDE

BY I-MING FENG
Mechanical Engineering Dept., Massachusetts
Institute of Technology, Cambridge, Mass.

Research results regarding the lubricating properties of molybdenum disulfide are reported in this paper. Its crystal structure, the methods of applying the compound, its friction coefficient under ordinary conditions, the result of X-ray diffraction study, and the effects of various factors, including the surrounding atmosphere, the temperature, the sliding speed, the normal load, and the crystallo-graphic orientation are discussed. Molybdenum disulfide is also frequently compared with graphite.

NEW HORIZONS IN RESEARCH

BY H. A. LEEDY
Director, Armour Research Foundation,
Illinois Institute of Technology, Chicago, Ill.

Technological research is one of the important signs of our times. Never before has a nation been so completely built around science and engineering developments, and never before has any nation been so completely dependent on these scientific advances.

Today research is receiving more attention and more funds are being expended by far than ever before in our history. Recent estimates have indicated that we have been spending over 2½ billion dollars annually on research and development, or approximately one per cent of our national income. Certainly in view of this, it behooves all of us to know more about research and its value to industry and to our government.

Only such preprints as are provided through the courtesy of the authors will be available for distribution at the Annual Meeting. The full text of the entire Annual Meeting proceedings will be published through the columns of this Journal as rapidly as space permits. If you are not an ASLE member, we urge you to send your subscription at once. You cannot afford to miss one valuable issue of LUBRICATION ENGINEERING.

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H. A. LEEDY

B. W. HOTTEN

R. J. TORRENS

J. R. ROUBIK

T. R. WITT

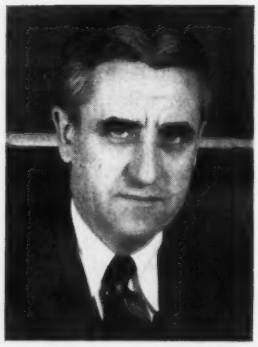
A. E. ROACH

E. R. BOOSER

K. O. TECH

C. W. THOMPSON

P. W. UHL



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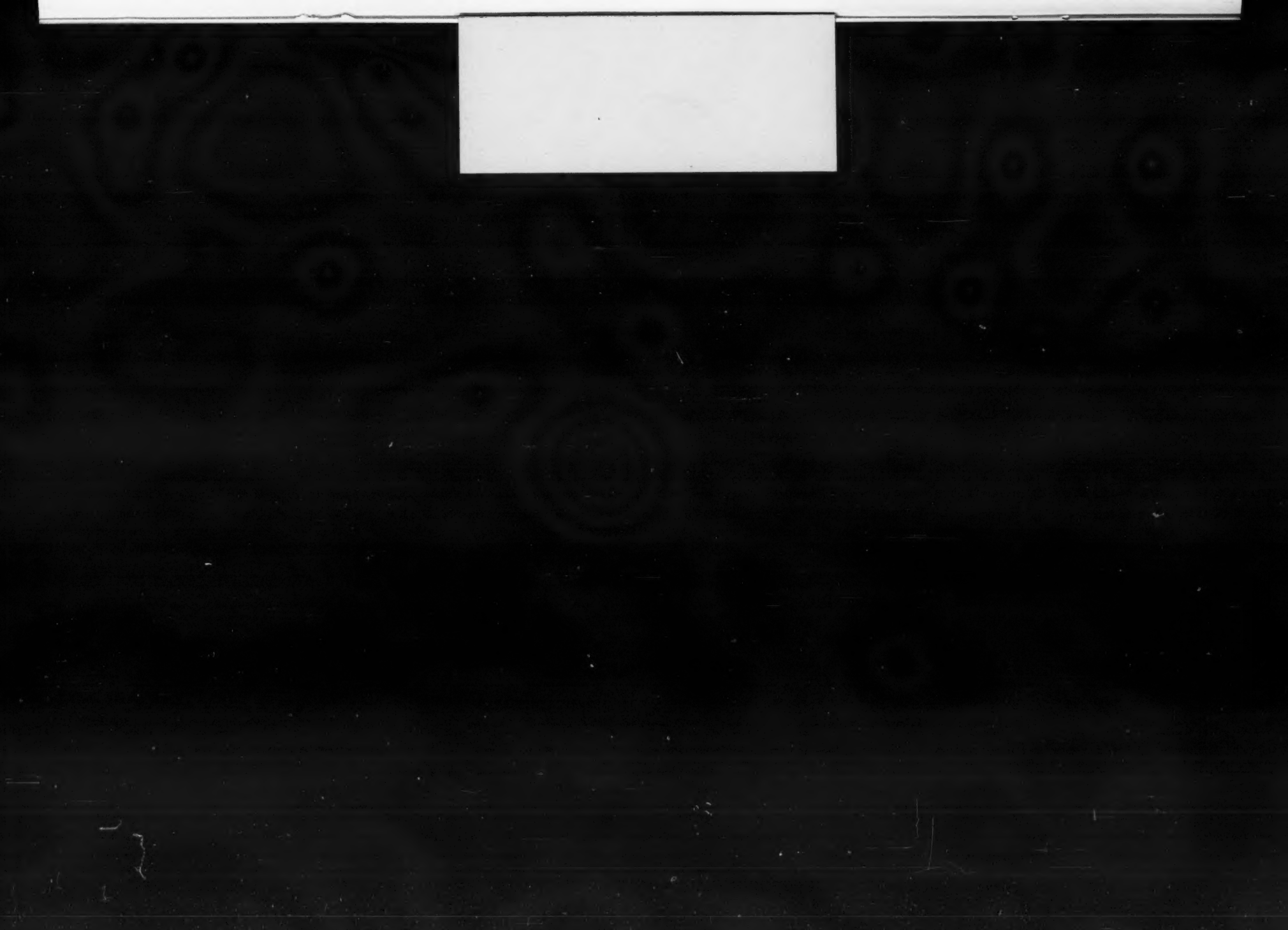

Authors of Papers

SEVENTH ASLE ANNUAL MEETING

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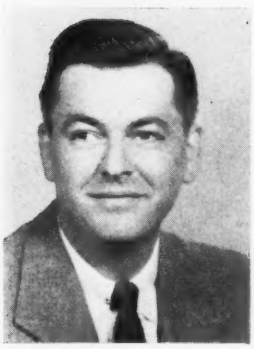
E. B. ETCHELS



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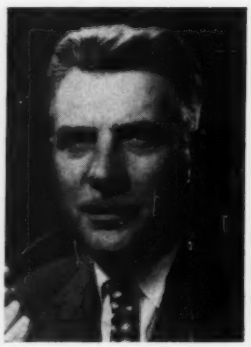

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Fifth Annual Exhibit Devoted Exclusively to Lubrication

THREE IMPORTANT DAYS

APRIL 7-8-9, 1952

HOTEL STATLER—CLEVELAND, OHIO

The leading manufacturers of lubrication products have combined to bring out the actual value of lubrication as a functional part of plant production and maintenance.

SHOWING: LUBRICANTS, PETROLEUM AND SYNTHETIC — CHEMICALS — ADDITIVES — CUTTING OILS AND COMPOUNDS — SPECIAL OILS AND GREASES—LUBRICATION DEVICES FOR APPLICATION—FILTRATION—TESTING — HANDLING — GEARS — THE LATEST DEVELOPMENTS AND METHODS COVERING THE ENTIRE FIELD OF LUBRICATION.

PROPER LUBRICATION — *The Insurance Policy of Production*

Among the Companies Exhibiting Are

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BOWSER, INC.....Fort Wayne, Ind.
BRIGGS FILTRATION CO.....Washington, D. C.
BROWN FUEL COMPANY, THE.....Cleveland, Ohio
CARBIDE AND CARBON CHEMICALS CO.....New York, N. Y.
CITIES SERVICE OIL CO.....New York, N. Y.
COMMERCIAL FILTERS CORP.....Boston, Mass.
CUNO ENGINEERING CORP.....Meriden, Conn.
DE LAVAL SEPARATOR CO., THE.....Poughkeepsie, N. Y.
DELPARK CORP.....Lebanon, Ind.
FARVAL CORP., THE.....Cleveland, Ohio
FREEDOM-VALVOLINE OIL CO.....Freedom, Pa.
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MANZEL, INC.....Buffalo, N. Y.
McCORD CORP.....Detroit, Mich.
NORGREN CO., C. A.....Denver, Colo.
NUGENT & CO., INC., WM. W.....Chicago, Ill.
PENOLA OIL CO.....New York, N. Y.
SHELL OIL CO.....New York, N. Y.
SINCLAIR REFINING CO.....New York, N. Y.
STANDARD OIL CO. OF OHIO.....Cleveland, Ohio
STUART OIL CO., LTD., D. A.....Chicago, Ill.
TEXAS COMPANY, THE.....New York, N. Y.
TIDE WATER ASSOCIATED OIL CO.....New York, N. Y.
TRABON ENGINEERING CORP.....Cleveland, Ohio
U. S. HOFFMAN MACHINERY CORP.....New York, N. Y.
WARREN REFINING & CHEMICAL CO., THE.....Cleveland, Ohio

• *EXHIBITION HALL — BALLROOM FLOOR* •

APRIL 7 .....9 A. M. to 10 P. M.
APRIL 8-9.....9 A. M. to 6 P. M.

MONDAY, APRIL 7
SPECIAL INDUSTRIAL NIGHT—6 P. M. to 10 P. M.

NEWS OF THE SECTIONS

CHICAGO

February 1952 meeting — This was Ladies' Night and, appropriately, the speaker was the first woman member of ASLE, namely, Dr. Helen Sellei of the Standard Oil Company (Indiana). Dr. Sellei gave a delightful talk on the topic "Research: Ability or Attitude?" to the enjoyment of the male members, their wives and lady friends.

YOUNGSTOWN

By J. P. Halwachs, Secretary

"Principles of Lubrication," by H. N. Kaufman, Research Laboratories, Westinghouse Electric Corp.—January 1952 meeting.

Mr. Kaufman illustrated his talk with plastic models as well as an interesting movie. His discussion, augmented by the models, illustrated the comparative features of dry and fluid friction and the effect of variations in area of sliding surfaces, load, velocity and thickness of oil film.

At this meeting a new feature was inaugurated—that of showing a film of general interest prior to the opening of the official meeting and technical session.

* * *

"Analyzing Sleeve Bearing Performance," by R. H. Josephson, Product Engineer, The Cleveland Graphite Bronze Co.—February 1952 meeting.

Mr. Josephson pointed out that with the reduction in size of various machines and engines for a given amount of output, the resulting bearing loads have increased tremendously. Not only has it been necessary to develop better bearing materials, but also careful investigation of the original design of the equipment must be made. The old "rules of thumb" no longer apply to the higher loads, temperatures and surface speeds.

Investigations of bearing temperatures and film thickness are extremely useful in determining the optimum clearance range. Investigations of the load patterns and dynamic distortions are particularly important on these highly loaded applications.

Sleeve bearings that are operating under distress, in most cases, indicate the conditions which are to blame. When these bearings are viewed by the trained eye and properly interpreted, corrective measures can in most cases be taken to prevent recurrence.

Several examples of difficult applications in which trouble has been eliminated by correct analyses were shown.

Assisting Mr. Josephson during the question and discussion period following was Richard J. Schager, Asst. Ch. Engr., Automotive & Diesel Department.

PHILADELPHIA

By J. H. Richards, Jr.
Program Chairman

November 1951 meeting—This meeting is of special interest to ASLE members and Sections, since it marked the conclusion of an educational course in lubrication engineering given to 65 representatives of local industry by the Philadelphia Section. These men were guests of the Section at this dinner meeting at which Mr. Carl Schmitz, National President; Mr. Henry Muller, Chairman of the New York Section; Mr. Charles Pritchard, first president of the Society; and Dr. Dudley Fuller, National Chairman of the Educational Committee were also present. Dr. Fuller served as master of ceremonies. Mr. Linden, a student in the lubrication course, was presented with a one-year membership in the Society as a prize for submitting the best question to the panel at the last session of the course.

(Editor's Note: We congratulate the Philadelphia Section on this fine educational activity, which has aroused much favorable comment from many sources.)

The speaker at this meeting was Mr. K. S. Smiley of E. I. duPont deNemours and Co., who outlined to the group in a very interesting manner the functions, activities and responsibilities of a lubrication engineer in industry.

* * *

January 1952 meeting — "Lubrication of Ball and Roller Bearings," by Roy L. Wheeler, Gulf Oil Co.

Mr. Wheeler augmented his talk with interesting slides and very thoroughly covered the lubrication problems involved in the wide field of application of ball and roller bearings. He particularly emphasized that the design features associated with the mounting of such bearings play a major part in the success or failure of their lubrication.

BUFFALO

By W. H. Miller, Chairman
Section News Committee

"Modern Manufacturing for Quality in Ball Bearings," by William Gustafson, Marlin-Rockwell Corp.—January 1952 meeting.

(SEE *Lubrication Summarized*)

"Sealing of Ball Bearing Housings," by E. W. Fisher, The Garlock Packing Co.—January 1952 meeting.

(SEE *Lubrication Summarized*)

Buffalo Section meetings are now punctuated by the resonant commands of a gavel. Silver plates, attached to both the gavel and its stand, are engraved as follows:

"Presented to Buffalo Section
by Ontario Section ASLE
December 11, 1951"

In addition to serving its functional purpose as a gavel, this gift will be cherished through the years by the Section as a constant reminder of the thoughtfulness, cooperation and friendship of its Canadian neighbors.

As part of the January meeting on ball bearings, Mr. Lembke from General Electric Company's Repair Department conducted an actual demonstration of removing, cleaning, inspecting, relubricating and replacing a grease-lubricated electric motor ball bearing. Emphasis was placed on correct use of proper tools and on cleanliness.

The February meeting consisted of an open discussion of gears. Questions, answers and comments originating from a large percentage of the group present resulted in the most successful meeting of this type which the Section has had to date.

PITTSBURGH

By M. C. Miller, Secretary

"Railway Bearings," by Edward Hoyer, National Bearing Division, American Brake Shoe Co.—January 1952 meeting.

(SEE *Lubrication Summarized*)

SYRACUSE

By R. Buyea, Secretary

"Reclamation and Reconditioning of Industrial Petroleum Products," by D. M. Cleaveland, Bendix Products Division, Bendix Aviation Corp.—January 1952 meeting.

Mr. Cleaveland's emphasis was on the relatively inexpensive and completely successful reclamation of actively sulphurized cutting oils. The speaker proved that this particular

(*Continued on page* 90)

N. I. WHITELEY
American Steel and Wire Co.,
Chairman, Cleveland Section

G. T. COLLATZ
The Farval Corp.,
Chairman,
Annual Meeting Comm.,
Cleveland Section

cleveland invites you

N. I. Whiteley, Chairman of the Cleveland Section, and G. T. Collatz, Chairman of the Cleveland Annual Meeting Committee, the members of the various committees, and the entire Cleveland Section membership welcome this opportunity of extending to you and to your wives a cordial invitation to attend the Seventh Annual Meeting and Fifth Annual Exhibit in Cleveland, Monday, April 7th, through Wednesday, April 9th.

"The privilege of being Host Section to the National Meeting is one which we in Cleveland sincerely appreciate, and to which we have looked forward eagerly. The program promises to be one of the most interesting and informative ever presented at one of our meetings, and should be of real value to every member of the Society. Supplementing the technical program, entertainment has been planned, both for the members and for their wives, which we believe will make your visit with us enjoyable in every way.

"The city itself has much to offer the visitor. With its great diversification of industry, and standing as it does on the shores of Lake Erie, Cleveland has well deserved its title of 'The Best Location in the Nation.' Morover, it is a beautiful city, with an extensive park system, cultural and formal gardens, and many distinctive public buildings.

"And don't forget that the meeting affords a wonderful chance for pre-Easter shopping in Cleveland's famous stores—so be with us if you can—we're anxious to see you all—in Cleveland!"

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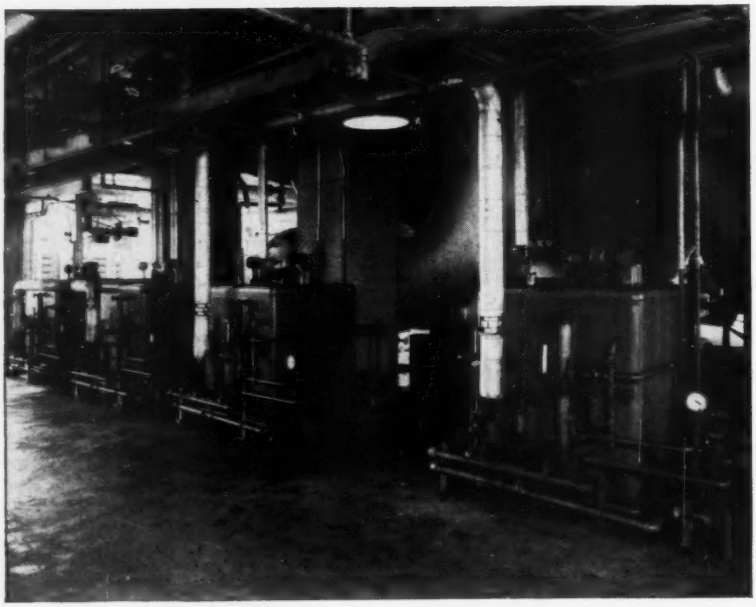
Lubrication Insurance for TURBINE BEARINGS



These Bowser turbine oil conditioners are serving two 12,900 c.f.m. and two 52,000 c.f.m. turbo-blowers.

For the first six months following installation the oil in each unit was tested every thirty days. It was found to be in such continuously perfect condition that the user* considers further tests unnecessary.

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NEWS OF THE SECTIONS

(*Continued from page* 88)

type of reclaiming fits into the picture of almost any industry using this type of product in considerable amounts.

The reclamation of hydraulic oils is feasible and the oil can be returned to its original value provided it does not contain oxidation inhibitors which are removed by the process.

The subject of pollution and its resulting effect on industry — the necessity of breaking emulsions so cleanly that the water can be carried away by sewers — was briefly discussed by Mr. Cleaveland.

LOS ANGELES

By R. C. Dishington, Secretary

"Diesel Engine Crank Case Explosions," by G. W. Ferguson, The Texas Co.—January 1952 meeting.

(SEE *Lubrication Summarized*)

This paper was presented by J. T. Bugbee, Research Engineer, The Texas Co. Mr. Bugbee followed this presentation with a motion picture and commentary concerning the laboratory equipment and techniques used in conducting the crank case explosion investigation.

The new slate of officers for the 1952 term was announced at this meeting.

(SEE *Section Officers* listing)

NEW YORK

By H. Muller, Chairman

"Gears, The Relation of Their Type to Lubrication," by P. H. Dreissigacker, Jr., Engineering Department, Farrel-Birmingham Co. — January 1952 meeting.

Mr. Dreissigacker pointed out that a set of gears will give the ultimate in service if properly designed and installed and if operated in the presence of the proper lubricants. He discussed recommendations to assure that gearing will perform the functions for which it was designed. The important provisions are: 1) correct installation, 2) adequate run-in to assure proper alignment and tooth contact, 3) production running within design limitations, 4) rigid preventive maintenance and inspection schedule.

KANSAS CITY

By C. J. Boner

The December meeting of the Kansas City Section was held at the Linda Hall Library on the evening of December 10, 1951. The librarian, Joseph C. Shipman, explained the coverage and detailed some of the

material available to technical people in this library.

The Linda Hall Library is devoted entirely to the literature of the physical sciences, omitting only material on clinical medicine. In five years a collection of over 125,000 volumes and over 8,000 separate titles of journals has been accumulated. Currently, about 3,700 different journals are received.

Mr. Shipman stressed the point that journals are the first and the original source of information; hence, these are a "must" for a technical library. Much historical material is also available such as the complete files of the first scientific journal published, the Philosophical Transactions of the Royal Society of London. The gathering was shown Galileo's *Dialogo,* 1632 Hook's *Micrographia,* 1665 and Newton's *Principia,* 1687.

It was explained that the facilities of this library are available to the entire Midwest and that photostat or microfilm reproductions can be secured of any material in the library.

CORRECTION: Through an error in our composing room the booth number for the MANZEL exhibit as shown in their ad on page 8 of the February 1952 issue of LUBRICATION ENGINEERING read "Booth 82." The correct booth number is "28" and we call your attention to their current display on page 57 of this issue.

Also, our apologies for the incorrect listing of Mr. Frank Ross' business affiliation under ASLE National Committee Chairmen in the two previous issues of LUBRICATION ENGINEERING. We hasten to assure Mr. Ross' many friends that his affiliation is still E. F. Houghton and Co. He is serving as chairman pro tem of the Technical Committee on Lubrication Economics in order to complete all arrangements for the Forum on Lubrication Economics sponsored by that committee on the program of the Annual Meeting, and is to be congratulated on the fine job done.

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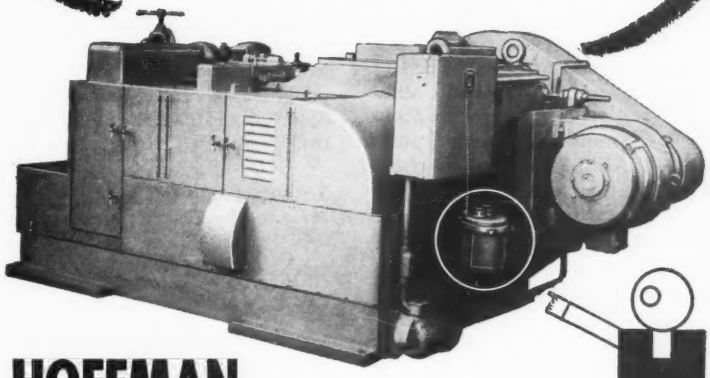
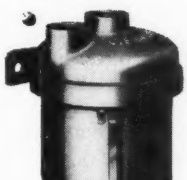


HOFFMAN DISC FILTERS NOW STANDARD on this Waterbury Farrel Hipro-Header

Despite a 10 to 1 difference in first cost, over previous filters, Hoffman Model I-6-15D Disc Filters proved more economical for Waterbury Farrel Foundry, builder of this high-speed Hipro Header.

Built to head bolts, screws, rivets, etc. from stock up to ⅜" O.D., this machine has a capacity of 115 units per minute. Extensive tests revealed that operation with the Hoffman filter meant greater lube oil clarity and longer filter disc life – thus, greater operating economy for the purchaser.

Hoffman disc filters have cleanable discs. Filtration at operating pressures up to 50 psi is accomplished without moving parts. Low maintenance cost. Write for Bulletin A669 for complete details *now*.



The I-6-15D

The I-4-15D

Hoffman Disc Filters, furnished in three sizes, may be installed singly or in units, to provide continuous clarification. Compact design for installation where space is limited. The I-4-15D delivers 1 to 10 g.p.m.; the I-6-15D provides 5-50 g.p.m. and the I-6-90D, 50 to 125 g.p.m. For the correct filter size for your requirement, Hoffman filtration engineers are at your service.

The I-6-90D

FILTRATION DIVISION
U.S. HOFFMAN MACHINERY CORPORATION
217 LAMSON STREET, SYRACUSE 6, N. Y.
CANADIAN PLANT: CANADIAN HOFFMAN MACHINERY CO., LTD., NEWMARKET, ONT.

LUBRICATION SUMMARIZED

Modern Manufacturing for Quality in Ball Bearings—By William Gustafson, Marlin-Rockwell Corp.

Submitted by W. H. Miller, Chairman Section News Committee Buffalo Section ASLE

The Anti-Friction Bearing Manufacturers' Association (AFBMA) Committees meet jointly with other engineering societies to discuss problems and formulate standard practice. All AFBMA Standards have been submitted to and approved by the American Standards Association and its member groups. These standards, available to all, cover:

1. Bearing identification code
2. Bearing mounting
   - Shaft and housing seat diameters
   - Shaft and housing shoulder diameters
3. Boundary dimensions
4. Gaging practice
5. Method for evaluating load ratings for ball bearings
6. Mounting accessories
   - Adapter sleeves
   - Locknuts
   - Lockwashers
   - Side run-out of lock washers
7. Packaging—recommended methods for domestic and export
8. Snap ring dimensions
9. Steel balls
10. Terminology—definitions of bearings and parts with bearing drawings.
11. Tolerances—classified as ABEC 1, 3, 5, 7, or special design

Bearing quality and size requirements as established by the user have increased to a point where practically all present manufacturing equipment and gaging facilities are becoming obsolete. Twenty years ago, tolerances were in the range of thousandths compared with millionths of today.

In order to produce the large volume of varied size bearings to acceptable quality levels, effective Process Development and Quality Control procedures are necessary. Inspection Departments use shop working tolerances based on AFBMA Standards and machine capability studies. Abnormal rejections must be investigated and the cause established and remedied.

At the present, bearing manufacturers are only able to produce quality consistent with the capabilities of available equipment and labor force. In efforts to eliminate known inaccuracies and variables it has actually been necessary to design completely new machine tools and fixtures. Marlin-Rockwell, in establishing a pilot line of entirely new machines, hopes to approach production of the true geometric bearing.

Sealing of Ball Bearings and Bearing Houses—By E. W. Fisher, The Garlock Packing Co.

Submitted by W. H. Miller, Chairman Section News Committee Buffalo Section ASLE

Bearing seals may be divided into two broad classifications:

1. Labyrinths, baffles and non-spring-loaded seals
2. Spring-loaded seals

Service requirements, available space and cost are determining factors in choosing between the two types.

In lightly loaded bearings, the need is mostly for a dirt seal. Here, a simple baffle or single-stage labyrinth is integrated with the bearing. For more severe cases, series baffles or multi-stage labryinths are used. However, definite mechanical clearances exist in these, allowing breathing action with possibilities of contamination. Non-spring-loaded seals of felt or rubber-like materials, by virtue of their resilient nature, initially contact the shaft. However, this initial shaft loading disappears due to gradual loss of resilience and elasticity of seal materials, resulting, in effect, in single baffles. Sealing efficiency is realized if non-liquid lubricants are used.

Heavy loads or extremely dirty conditions require spring-loaded seals which maintain continual shaft contact. The spring-loaded seal is actually a plain bearing and provision for its lubrication and dissipation of the heat it generates may require separation of the seal and bearing, resulting in a sealed housing containing a bearing. Proper balance of the spring load—heavy enough to maintain contact but light enough to minimize power loss and heat generation—is important.

Correct installation of seals is very important. Proper mounting tools and methods should be used. Spring-loaded seal installations, especially on grease-lubricated applications, should include a housing pressure relief to avoid seal rupture. If no vent is provided, at least one seal should face outwardly.

Seals are manufactured to operate at various temperatures with various lubricants. Selection of a seal designed to function under the conditions for which it is used is necessary for proper operation.

Railway Bearings—By E. Hoyer, National Bearing Division, American Brake Shoe Co.

Submitted by M. C. Miller, Secretary Pittsburgh Section ASLE

Of all the railway bearings the most interesting is the journal bearing. It has the greatest job to do and under the most varying conditions. These bearings are partial bearings, being somewhat less than one hundred twenty degrees. The bearing backs are made of high lead bronze and are of a steeple-back design. They are babbitt lined with a lead-base babbitt one quarter of an inch thick. The bore of the bearings is one-sixteenth over the nominal journal diameter, but the axles may be turned down and used until they are one-half inch under nominal diameter.. This allowable difference between bearing bore and journal diameter explains why the babbitt is one-quarter inch thick—to provide for necessary deformation.

Lubrication is effected by means of waste properly saturated with car oil. The waste may be cotton (which has the greatest capillarity), wool (which has the greatest resiliency), or a combination of both cotton and wool (which provides the best properties) in the proportions of sixty and forty respectively. Car oil may be winter, summer (depending upon the season) or an all-year grade.

Freight cars operate all over the country as well as Canada and Mexico on all railroads. They can go from forty degrees below zero to a climate of eighty or ninety degrees in a single day. They may go through unloading devices where the whole car is turned upside down. Cars may also be humped or coupled with an impact sufficient to raise bearings off the journals as much as an inch.

Railroad car speeds may vary from zero to one hundred miles per hour. Loads on bearings may be as high as six thousand pounds per square inch, initially.

There are over seventeen millon journal bearings in service, and inter-

change of all component parts may be effected with a minimum of effort and expense due to the standardization of these parts by the Association of American Railroads. Nowhere can you find a bearing which does such a wonderful job under such varied conditions as the "Solid Journal Bearing."

Diesel Engine Crankcase Explosions
—By G. W. Ferguson, The Texas Co.
Submitted by R. C. Dishington, Secretary Los Angeles Section ASLE

A significant increase in the number of crankcase explosion accidents, some of which were fatal, has accompanied the tremendous increase in the use of diesel power within the past ten years. In an attempt to correct this condition, the author and his company initiated an investigation as to the mechanism of these explosions and correspondingly the inflammation properties of various oils commonly used in diesel engine lubrication. This report includes their laboratory investigation totogether with a summary of 104 diesel crankcase explosions, based on available literature and accident reports.

The crankcase atmosphere of a normally operating diesel engine burning liquid fuel was not found to contain explosive gases, but a potentially inflammable mixture of air charged with oil particles together with only negligible quantities of oil vapor. The crankcase atmosphere of the dual-fuel engine is not significantly different from that of engines burning 100 per cent liquid fuel, but does contain minor amounts of inflammable gases. Inflammable gas/air mixtures were considered possible only where excessive blow-by of natural gas might result from increased ring wear and piston clearances.

The limits of inflammability of certain hydrocarbon gases and the mist and vapor of various oils were studied. The lower limit for a finely divided oil mist was found to be essentially the same as that of its vapor. Also, it was indicated that the lower limit of inflammability of a lubricating oil mist compares very well with that of the vapors of the lower flash point hydrocarbons. The effect of oxygen on these limits was examined and it was concluded that flame will not propagate where the concentration of oxygen is low (approximately 12 per cent). Further, if there is a sufficient time lag before enough energy can be transferred from an overheated part to the oil mist/air or oil mist/natural gas/air mixture to produce ignition the atmosphere becomes too rich for flame propagation.

With few exceptions, the ignition of the potentially inflammable crankcase mixtures has been due to some overheated engine part such as a seized piston, bearing, etc. With a surface heated to approximately 1450 F. in an oil mist/air mixture there is an appreciable time lag before general ignition occurs. Only after this time lag do the physical agitation, vaporization, partial oxidation, and thermal decomposition of the oil particles in the presence of air finally result in an inflammable mixture, which upon ignition will give up sufficient energy to the surrounding mixture for the flame to propagate throughout the whole crankcase atmosphere.

From data obtained, no significant differences were found in the minimum ignition temperatures of the various oils commonly employed in diesel lubrication, nor was there any appreciable lowering of the minimum ignition temperature when the oil was diluted with up to 20 per cent diesel fuel. Thus it was suggested that the problem might best be attacked by further critical studies of maintenance procedures and continued refinements in engine design.

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CURRENT LITERATURE

Automotive Industries, Vol 106, No. 1, January 1, 1952

COOLANT SEPARATOR

Anon.—p. 66

Designed for installation on many types of grinding, honing and gear shaving machines is a magnetic coolant separator being produced by the Sundstrand Magnetic Products Co., Div. Sundstrand Machine Tool Co., Rockford, Ill. This separator is completely automatic. It cleans the coolant as the liquid passes under a revolving drum of solid Alnico which is permanently charged.

HYDRAULIC FLUID

Anon.—p. 68

A hydraulic fluid of the water-base type, developed by R. M. Hollingshead Corp., Camden, N. J., and by Navy's BuAer and offered under the trade name H2 hydraulic fluid, has been approved by the Navy's Bureau of Aeronautics and is being used in Navy aircraft. It contains a minimum of 35 per cent water, with other materials to give it good lubricity and to make it serviceable at -60 F. Composition is not given.

Chemical Processing, Vol. 14, No. 12, December, 1951

FILTRATION SAVES $1000/MONTH IN LUBRICANT ALONE ON WIRE DRAWING MACHINES

Anon.—pp. 52-53

A system of continuous filtering using filter media composed of brilliant asbestos and activated carbon made by the Hercules Filter Corporation, is used at the Newark, N. J. plant of Wilbur R. Driver Co. to prevent shutdowns due to foaming, rusting or similar interruptions caused by dirt particles in the lubricants.

Corrosion, Vol. 8, No. 1, January, 1952

WHY DO BEARINGS FAIL? FACTORS RESPONSIBLE FOR THE SHORT LIFE OF BEARINGS

Larre, R.—p. 18

(Metalurgia y Elect., Vol. 13, No. 147, p. 18, pp. 21-23, 1949)

Bearings fail through wear, errors in adjustment, inadequate load distribution, bad alignment, incorrect allowance for oil film, defective lubrication, fatigue, overload, corrosion, extraneous materials on the bearing surface and manufacturing defects. Some illustrated examples are given of bearing failures and their causes.

Erdol Und Kohle, Vol. 4, No. 10, October, 1951

BEHAVIOR OF CIRCULATORY PUMPS FOR DELIVERING VISCOUS OILS

Imberger, F.—pp. 641-643

Mathematical data are presented and several graphs are given.

OILS FOR THE TEXTILE INDUSTRY

Cibula, G.—pp. 657-660

The author takes up lubricating oils and fats for lubricating textile machines, special lubricating oils and greases for this type of machine and textile oils themselves for the treatment of wool, cotton etc.

MODERN GREASES

Anon.—p. 660

The operation of modern machinery would be unthinkable if the grease industry had not advanced. Solid greases have been known for about 70 years. By saponifying natural fats or fatty acids obtained from them in the presence of mineral oils characteristics are obtained that are desirable. Such greases consist of three components, mineral oil, soap and water. The components of greases are usually present in the colloidal state. There is however also a crystalline structure that is possible. Various German factories are very briefly mentioned. Oxidation of paraffins, use of synthetic fatty acids for preparation of greases are considered.

Chemical Abstracts, Vol. 45, No. 22, November 25, 1951

POLAROGRAPHIC DETERMINATION OF COBALT IN USED TRACTOR LUBRICATING OILS

Koltypin, S.—p. 10553-10554
(Zavodskaya Lab. Vol. 16, p. 1430-1, 1950)

DETERMINATION OF MOISTURE IN REFRIGERATION OILS

Bopp, J.—p. 10554
(Refrig. Eng. Vol. 59, pp. 891-3, 1951)

GOOD COMPRESSOR PERFORMANCE DEMANDS THE RIGHT LUBRICATING OIL

Brewer, A.—p. 10554
(Refrig. Eng. Vol. 59, pp. 965-7, 1951)

WETTING CHARACTERISTICS OF LUBRICATING AEROSOLS

Faust, D.—p. 10554
(Products Eng. Vol. 22, No. 7, pp. 13-4, 1951)

ADDITIVES FOR LUBRICATING OILS

Booser, E.—p. 10554
(Gen. Elec. Rev. Vol. 53, No. 8, pp. 9-13, 1950)

NEW ANTIOXIDANT FOR FINE MECHANICAL LUBRICANTS

Csokan, P. and Szabolcs, L.—p. 10554
(Magyar Kem. Lapja, Vol. 6, pp. 123-7, 1951)

LABORATORY SCREENING OF MULTIPURPOSE GREASES

Kipp, E. M. and Zeiler, C. pp.—10554-10555
(Iron Steel Engr. Vol. 28, No. 9, pp. 107-111, discussion, 111-13, 1951)

ANTICORROSION ADDITIVES FOR LUBRICATING OILS

Michalowska, J.—p. 10555
(Przemyst Chem. Vol. 6, No. 29, pp. 12-20, 1950)

The theory of corrosion and the chemistry of various kinds of inhibitors are reviewed.

ADDITIVES FOR LOWERING THE MELTING POINT OF LUBRICATING OILS

Michalowska, J.—p. 10555
(Przemyst Chem. Vol. 6, No. 29, pp. 120-124, 1950)

Preparation of additives of the "Paraflow-type" by the condensation of chloroparaffins with aromatic hydrocarbons is described. The addition of 0.5-1.0% of the condensation product to different lubricating oils lowered the melting point around 30 F.

Fuel Abstracts, Vol. 10, No. 3, September, 1951

SELECTIVE ADSORPTION INVESTIGATION OF LUBRICATING OILS #1859

Kralik, A. and Vajta, L.—p. 69
(Magyar Kem. Folyoirat, Vol. 56, pp. 38-41, 1950)

A cotton disc 2 cm. thick and 350 g. were the filter materials and 1600 ml. of 60/90 gasoline served as the solvent and eluent. The color of eluates varied from colorless to light yellow and red (with a greenish fluorescence). A linear correla-

tion was observed between index of refraction and specific gravity; this can be utilized for the determination of the specific gravity of very minute amounts of eluates. A similar correlation exists between refractive index and viscosity. By the use of longer adsorption columns, the stability against oxidizing effects of the single eluates of lubricating oils can be examined.

FRICTIONAL PROPERTIES OF HIGH PRESSURE LUBRICANTS #1862

Soda, N. and Okamoto, S.—p. 70
(Rep. Inst. Sci. Tech. (Tokyo University), Vol. 1, pp. 135-140, 1947)

The frictional coefficients of high pressure lubricants composed of nonpolar mineral oil containing some additional reagents were measured by a friction tester of the pendulum type. 28 reagents tested are divided into 4 classes according to their frictional coefficients. The frictional properties have some relation to the chemical composition whereas the wear reducing action of these reagents has no relation to their frictional coefficient.

Industrial Laboratories, Vol. 3, No. 1, January, 1952

FUNDAMENTAL ASPECTS OF LUBRICATION

Miner, R.—p. 13
(New York Academy of Sciences, Vol. 53, Article 4, pp. 753-994 of the Annals of the Society, 1951)

This paper bound book contains thirteen papers by fifteen authors on the subject of lubrication. The papers are on the theoretical or physical-chemical aspects of lubrication. Topics include electron diffraction studies of surfaces, surface chemical phenomena, surface film properties, viscosity and structure, frictional coefficients, the metal cutting process, fine structure of greases.

Industry and Power, Vol. 61, No. 6, December, 1951

BEARING LUBRICATION . . . HOW TO DO IT WITH OIL

Trail, T.—pp. 74-75, 111

Various methods of lubricating journal bearings with oil are detailed.

Journal of the Institute of Petroleum, Vol. 37, No. 336, December, 1951

GEAR LUBRICANT—CONSTRUCTIONAL GEAR MATERIAL

Blok, H.—p. 583A
(Ingenieur, Vol. 63, No. 39, p. 053, Sept. 9, 1951)

For purely mineral oils it is not viscosity at the operating temperature, but viscosity grade that is to be considered as approximately indicative of the protection they afford against scuffing.

SOME HIGHER ALKYL NAPHTHENATES AS LUBRICATING OIL FOR FINE INSTRUMENTS

Kuwata, T., Noguchi, S., and Ando, H.—p. 583A
(Bull. Chem. Soc. Japan, Vol. 24, No. 3, pp. 157-60, July 1951)

The syntheses of 2-ethylhexyl, n-octyl, decyl, lauryl, cetyl, oleyl, and sperm esters of naphthenic acid and lauryl (industrial) and sperm liquid esters of crude naphthenic acids are described, and their properties are reported. These higher fatty alkyl esters possess excellent qualities as lubricating additives for the lubrication of delicate instruments.

Power, Vol. 95, No. 12, December, 1951

POWERS' HANDBOOK ON BEARINGS AND LUBRICATION

O'Connor, J. J.—pp. 79-109

The following subjects are considered: Friction: how to lick it, guide to sliding bearings, guide to rolling bearings, testing the lubricant, oils, synthetics, additives, greases, solid lubricants, keeping used oil usable, applying the lubricant and planned lubrication pays.

Vol. 96, No. 1, January, 1952

HOW NOT TO LUBRICATE A BEARING

Anon.—p. 120

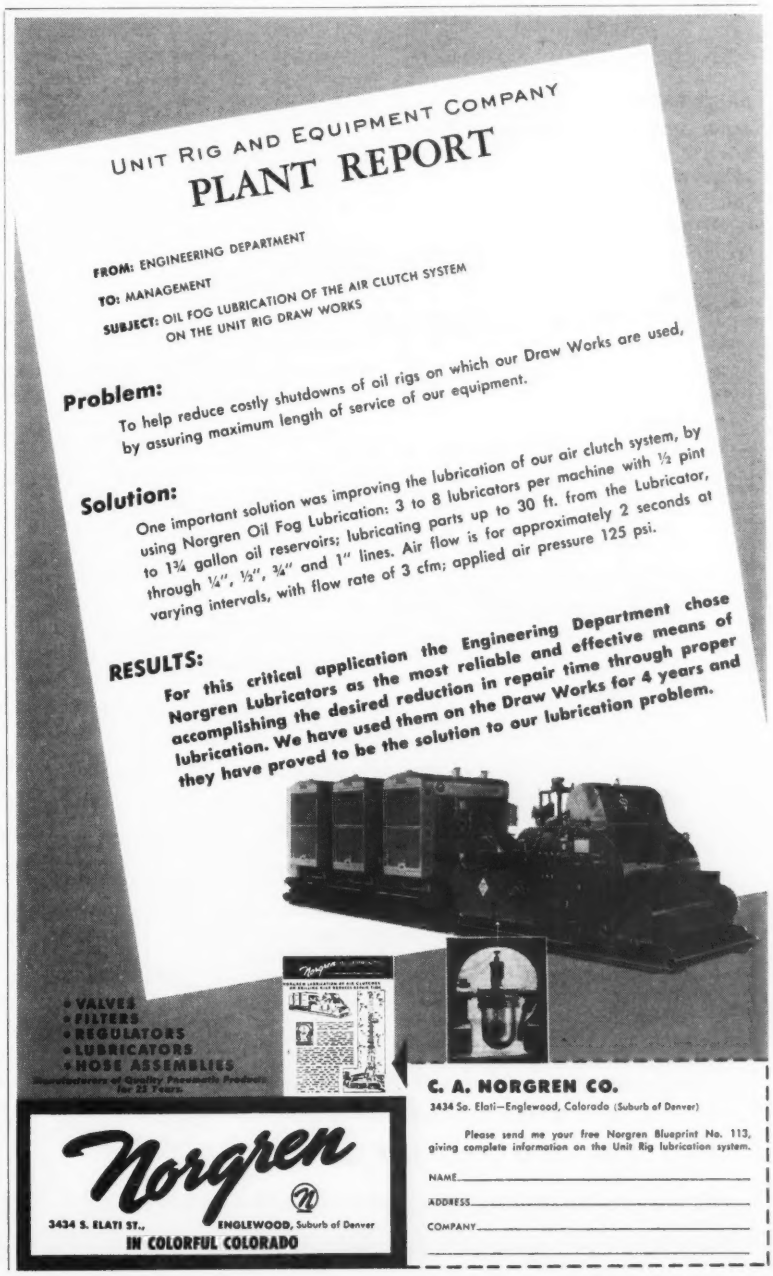
More motors are damaged by overlubrication than are hurt by neglect or lack of it. Motor manufacturers have become more and more aware of this plant problem. There's a trend among them to lengthen the span between grease jobs. Part of the reason, of course, is improved greases and bearings.

World Oil (Canadian Issue), Vol. 133, No. 7, December, 1951

HOW TO MAINTAIN CONVENIENT SUPPLIES OF LUBRICANTS

Anon.—p. 212

Arrangement for a "junior" service station adjacent to a pressure maintenance plant where it is necessary to have on hand a supply of more than one type of lubricant is described.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TO: MANAGEMENT
SUBJECT: OIL FOG LUBRICATION OF THE AIR CLUTCH SYSTEM ON THE UNIT RIG DRAW WORKS
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For this critical application the Engineering Department chose Norgren Lubricators as the most reliable and effective means of accomplishing the desired reduction in repair time through proper lubrication. We have used them on the Draw Works for 4 years and they have proved to be the solution to our lubrication problem.
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LUBRICATION IN THE NEWS

DRUM RACK: This recently designed drum storage rack is of particular interest to manufacturers, distributors and warehousers of oils, chemicals, etc. It is constructed of welded square tubular steel, thus making it capable of safely handling heavy loads.

The manufacturer claims its principal advantages are that the racks permit stacking drums to ceiling heights while at the same time selection of any drum can be made without shifting or disturbing others. Design permits removal by fork truck, and horizontal position makes possible the use of faucets for drawing off small quantities. It also lends itself to ready knock-down and rearrangement to meet changing warehouse conditions.

Initial racks are engineered for 55-gallon drums.

Write the manufacturer for information regarding this new drum rack or designing racks for smaller sized drums and special shape containers.

Equipment Manufacturing, Inc.
21550 Hoover Road, Detroit, Mich.

CHEMICAL TREATMENT: Rustshield 2, a chemical treatment that produces an oil-retaining rustproof surface for moving metal parts, is described in a new 4-page publication. The booklet discusses application methods and advantages of using the product on sliding and bearing surfaces. A variety of precision parts and defense components are given the Rustshield treatment to meet U. S. Army Ordnance Specifications 57-0-2C, Type II, Class A, and Military Specification MIL-C-16232 (Ships), Type I.

Copies of the booklet are available to readers on request.

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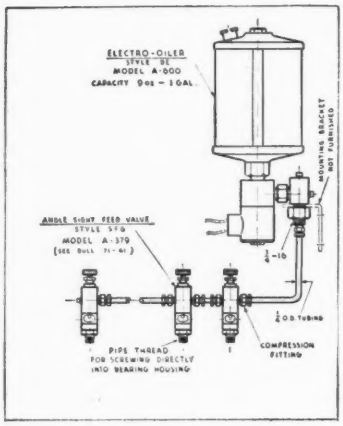
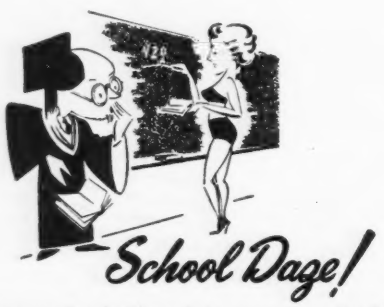


ELECTRO-OILER: The Electro Oiling System Style DEI, is a single-line gravity-feed system, entirely automatic in operation. It consists of a central reservoir with a solenoid-operated shut-off valve and a number of individual valves mounted



Just because that bathing suit is proper at the beach, she shouldn't assume it's proper for the classroom, too!

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directly into the bearings. Copper tubing connects the reservoir and all valves in series in such a manner that gravity flow will be maintained.

Oil is released by gravity from a reservoir by a solenoid-operated valve through tubing to an Angle Sight Feed Valve from which it can flow through an opening in the valve to the adjacent valve. A series connection is thereby established and oil is available in each valve for discharge to bearings. Each valve can be mounted at any height as long as the reservoir is mounted higher than the highest valve.

Every Sight Feed Valve can be individually regulated and smooth adjustments made and retained for proper drop feeding. They are available in three body sizes to suit the application, and can be used singly or gang-mounted.

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If the oil you make is used for slushing, cutting, grinding, quenching, parting, penetrating or lubricating it will pay to investigate the high rust-inhibiting properties of Sperm Oil.

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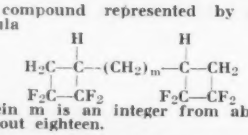
PATENT ABSTRACTS— OILS AND LUBRICANTS

Mineral Oil Composition containing a Polymericalky Metaphosphimate — Patent #2,580,587—Ferdinand P. Otto and Robert W. Barrett, assignors to Socony-Vacuum Oil Co., Inc.

A mineral lubricating oil containing a minor proportion, sufficient to depress the pour point thereof, of a polymeric n-tetradecyl metaphosphimate product obtained by (1) reacting a phosphonitrillic halide with n-tetradecanol at a temperature not in excess of about 150 C. to form n-tetradecyl metaphosphimate and (2) subjecting the metaphosphimate to polymerization by the method selected from (a) further heating the metaphosphimate product at a temperature not in excess of 150 C. in the presence of a polymerization catalyst, and (b) heating the metaphosphimate product at a temperature ranging from about 200 C. to about 400 C.

Fluorine-Containing Lubricant — Patent #2,582,283 — Alexander N. Sachanen, assignor to Socony-Vacuum Oil Co., Inc.

A compound represented by general formula



wherein m is an integer from about ten to about eighteen.

Lubricating Oil Additives—Patent #2,582,708—Samuel B. Lippincott and Alexander H. Popkin, assignors to Standard Oil Development Co.

A product consisting essentially of an esterified condensate obtained by subjecting to a temperature of about 40-150 C., about 1 mol of a compound selected from the class consisting of ethylene-1, 2-dicarboxylic acids, methylene succinic acids, and their anhydrides, and about 1-4 mols of butadiene monoxide wherein the esterification agent is selected from the class consisting of monohydric primary substantially straight chain alcohols, containing from 8-24 carbon atoms.

Detergent Oil Composition and the Method for its Preparation—Patent #2,582,958—Elmer W. Brennan and Norman D. Williams, assignors to The Pure Oil Co.

The method of preparing a composition suitable as a lubricant additive comprising preparing a salt of wool grease and a metal selected from the group consisting of zinc, barium, calcium, strontium, magnesium, tin, lead, nickel, and cobalt, reacting the salt with a sulfide of phosphorus at a temperature between 200 and 300 F. for a period of time sufficient to sulfurize and phosphorize the salt, and neutralizing the sulfurized-phosphorized salt with a basic compound of a metal of the group consisting of zinc, barium, calcium, strontium, magnesium, tin, lead, nickel, and cobalt, the total amount of metal reacted to form the resulting product being substantially in excess of the amount required to saponify the wool grease.

Printed copies of patents are available from the Patent Office at twenty-five cents each. Address the Commissioner of Patents, Washington, D. C., for copies and for general information concerning patents.

From Official Gazette—Vol. 654, Nos. 1, 2, 3, 4, 5; Vol. 655, Nos. 1, 3, 4.

Prepared by ANN BURCHICK

Nonspreading Lubricant—Patent #2,583,200—George E. Barker, assignor to Elgin National Watch Co.

A non-spreading lubricant having a base consisting of 50 to 90 parts by weight of a non-spreading component and 50 to 10 parts of a spreading component, said components being compatible and intersoluble in one another; said non-spreading component consisting of a liquid homologous mixture of stable non-volatile polar aralkyl compounds each having an alkyl chain and a nuclear aromatic radical connected to said chain and including a strong non-anionic negative group, demonstrating a positive contact angle with a steel surface in excess of 10 degrees and having a surface tension of at least 35 dynes per centimeter, the alkyl chain having from about 5 to 21 carbon atoms, said spreading component consisting of a liquid mixture of stable non-volatile organic compounds each containing a saturated aliphatic chain of 4 to 16 carbon atoms and at least two polar groups, of which one is the ester group and another is selected from the radicals consisting of the ester group and the aryl groups; said lubricant being further characterized in containing less than 5% of mineral oil lubricant and for the remainder consisting of not exceeding 1% of modifying agents to improve oiliness and coefficient of friction.

Extreme Pressure Greases—Patent #2,583,394—John E. Schott and Eldon L. Armstrong, assignors to Socony-Vacuum Oil Co., Inc.

A method of producing a lubricating composition comprising, mixing together with a mineral oil basic compounds of lead and of a metal selected from the group consisting of calcium, barium, magnesium and strontium, with less than their equivalent of high molecular weight saponifiable material and with a small

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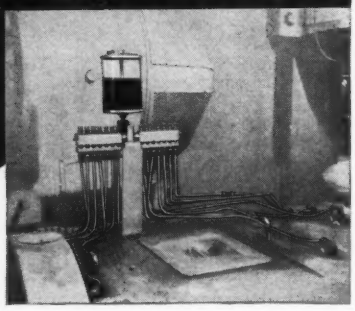

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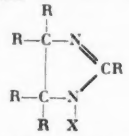
proportion of a mono-basic fatty acid having less than 4 carbon atoms sufficient in amount to substantially neutralize the excess basic metal compounds, the amount of said saponifiable material being sufficient to neutralize a major fraction but substantially less than all of said basic compounds and the basic compounds of lead and of soap-forming metal both being present in substantial amounts, heating the mixture under pressure while mixing to effect all the saponification simultaneously, thereafter releasing the pressure and heating the material at substantially atmospheric pressure to effect substantial dehydration, adding a minor proportion of a non-corrosive sulfurized fatty oil to the mixture and finally cutting back the mixture with additional mineral oil to the desired consistency.

Lubricating Oil—Patent #2,581,132—Roy F. Nelson and Melvin R. Hefty, assignors to The Texas Co.

A lubricating composition adapted to form a water-in-oil emulsion in the presence of water, with the water in the discontinuous phase, comprising a mineral lubricating oil as the predominant constituent, and constituting at least 90% by weight of the composition, and about 0.05-0.1% by weight based on the composition of a substituted glyoxalidine having the formula



where R is selected from the group consisting of hydrogen and lower alkyl, R′ is selected from the group consisting of alkyl and alkenyl radicals having from 10 to 30 carbon atoms, and X is selected from the group consisting of hydroxy lower alkyl, amino-lower alkyl and amino-alkylene-imino-lower alkyl.

High Temperature Grease—Patent #2,583,435 — Arnold J. Morway, assignor to Standard Oil Development Co.

A process for the manufacture of a mixed base lubricating grease composition which comprises admixing with a mineral base lubricating oil from about 2 to 4% by weight of an unsaturated aliphatic monobasic acidogenic material having from 3 to 4 carbon atoms selected from the class consisting of acrylic acid, methacrylic acid, crotonic acid, and their nitriles, adding to said mixture from 1 to 3% of an alkali metal hydroxide in aqueous solution to convert said acidogenic material to the alkali metal salt, stirring the mixture until the said acidogenic material is substantially completely neutralized thereafter adding from about 10 to 20% by weight of a high molecular weight saturated fatty acid in admixture with additional mineral oil, raising the temperature of the resulting mixture to one within a range of from about 120 F. to 170 F., adding to the said heated mixture a mineral oil slurry containing about 1 to 3% by weight of an alkaline earth metal hydroxide to neutralize said high molecular weight saturated fatty acid, raising the temperature of the resulting mixture to one within a range of from about 350 F. to 450 F., thereby dehydrating said mixture and cooling the resulting grease composition.

Metal Protecting Compositions — Patent #2,582,733—John C. Zimmer and Gordon W. Duncan, assignors to Standard Oil Development Co.

A non-corrosive metal protective composition consisting essentially of from 90% to 99% by weight of a mineral base lubricating oil and from 1% to 10% by weight of methyl amine petroleum sulfonate wherein the molecular weight of the uncombined petroleum sulfonic acid is between 350 and 500.

Thienylthio Carboxylic Acids and Thienylthio Carboxylic Acid Esters in Lubricating Compositions—Patent #2,581,626—John W. Brooks, assignor to Socony-Vacuum Oil Co., Inc.

An improved mineral oil composition comprising a major proportion of mineral oil and in admixture therewith a minor proportion, less than about 10% by weight but sufficient to stabilize said oil against the deleterious effects of oxidation.

Diesel Fuel Oil — Patent #2,582,192 — George H. Denison, assignor to California Research Corp.

An improved diesel fuel oil containing essentially a major portion of a diesel fuel oil having a substantial gum-depositing characteristic and a minor portion sufficient to inhibit formation of gum of reduced petroleum nitrogen bases comprising a homologous mixture of heterocyclic secondary amines having a basic dissociation constant higher than 1.0×10^{-4} prepared by extracting a crude petroleum oil fraction containing nitrogen bases with a dilute mineral acid to form water-soluble salts of mixed nitrogen bases, separating the salts from the petroleum oil fraction, neutralizing the salts to convert them to crude nitrogen bases, hydrogenating the bases at an elevated temperature and pressure in the presence of a sulf-active hydrogenation catalyst to form reduced petroleum nitrogen bases.

Extreme Pressure Lubricating Grease — Patent #2,581,126—Arnold J. Morway and John J. Kolfenbach, assignors to Standard Oil Development Co.

A lubricating grease composition having extreme pressure properties consisting essentially of a lubricating oil thickened to a grease consistency with a combination of 1 to 3 molar parts of metal soap of higher fatty acids and 1 to 3 molar parts of the non-volatile Cannizzaro reaction products of an alkali metal hydroxide and a sulfur-containing heterocyclic aldehyde of molecular weight below about 200, said grease including substantial amounts of the sulfur-bearing alcohol formed in said Cannizzaro reaction.

Grease Dispersion — Patent #2,580,654—George V. Browning, assignor to Standard Oil Co.

An aerosol dispensable lubricant composition which consists essentially of a lithium soap-oil grease having a soap content in the range of about 4 to 20% by weight and characterized by a soap fiber length of the order of one micron dispersed in a mixture of trichloro-monofluoromethane and dichlorodifluoromethane,

(*Continued on page* 100)

PERSONALS

WILLIAM H. OLDACRE
1892 - 1952

The many friends of W. H. Oldacre, President and General Manager of the D. A. Stuart Oil Company, were shocked to learn of his death on January 18.

He was widely known for his experience and knowledge pertaining to metal cutting and cutting fluids of all types. His advice and counsel have been of great value to the metal cutting industry.

Mr. Oldacre was active in all of the major technical societies, a past President of NLGI, and the first Chairman of the C.R.C. Gear Oil Projects Group, which during World War II assisted the Armed Services in the solution of lubricant problems. He has published many papers on the subjects of cutting fluids and metal working.

Mr. Oldacre generously devoted much of his time to ASLE activities, and was always "on call" to speak before the local Sections of the Society. He will be greatly missed by all who knew him.

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PATENT ABSTRACTS

(*Continued from page 99*)

the amount by weight of the lithium soap-oil grease in the total composition being in the range of .5 to 20% and said composition being further characterized by having the oil component of the grease dissolved in the mixture of trichloromonofluoromethane and dichlorodifluoromethane at a temperature and pressure to maintain these components in liquid phase without dissolving the lithium soap fibers whereby unaltered lithium soap fiber clusters are retained as a suspension therein so that when said suspension is sprayed on a surface to be coated, the trichloromonofluoromethane and dichlorodifluoromethane will evaporate and the deposited film will consist essentially of a grease consisting of meshed lithium soap fibers with oil retained therein, said grease having substantially the same structure and physical properties as the original lithium soap grease.

Silica Base Lubricating Greases—Patent #2,583,606—Aurelio F. Sirianni and Ira E. Puddington, assignors to The Honorary Advisory Council for Scientific and Industrial Research.

A lubricating grease consisting predominantly of mineral base lubricating oil thickened to a grease consistency with silica gel which has its normal water content replaced by said oil, said gel being waterpoofed by 10 to 100% by weight, based on the dry weight of the gel, of an organo silicon polymer of general formula

where R is alkyl or alkoxy.

Heavy Duty Lubricating Grease—Patent #2,583,436—Arnold J. Morway and Earl W. Ball, assignors to Standard Oil Development Co.

A lubricating grease composition consisting essentially of about 30 to 40% by weight of asphaltic residuum, of between 1000 and 5000 SSU viscosity at 100 F., about 10% of lead soap as an extreme pressure additive, about 8 to 18% sodium soap of rapeseed oil, about 0.05 to 1% of an oil soluble petroleum sulfonate as a rust inhibitor, the remainder of the composition being mineral base lubricating oil of 35 to 300 SSU viscosity at 210 F.

Substituted Thickener Lubricating Grease — Patent #2,583,603 — Aurilio F. Sirianni and Ira E. Puddington, assignors to The Honorary Advisory Council for Scientific and Industrial Research.

A lubricating composition consisting essentially of mineral base lubricating oil thickened to a grease-like consistency of 1 to 20% by weight, based on the total composition, of an inorganic oxygen containing gel voluminous precipitate having its normal liquid content replaced by said lubricating oil, and 0.5 to 2% of a polystyrene water-proofing agent covering said precipitate in a compressed substantially monolayer coating to inhibit moisture absorption by said precipitate.

Lubricating Grease—Patent #2,583,604—Aurelio F. Sirianni and Ira E. Puddington, assignors to The Honorary Advisory Council for Scientific and Industrial Research.

A composition consisting essentially of an oily synthetic ester of a dibasic acid thickened to a grease-like consistency with 1 to 20%, dry weight, based on the total composition, of silica gel having its normal water content substantially entirely replaced by said oily ester and 10% to 100% of an organosilicon polymer water-proofing agent, based on the dry weight of gel, to inhibit moisture absorption by said gel.

Silica Base Lubricating Grease — Patent #2,583,605—Aurelio F. Sirianni and Ira E. Puddington, assignors to The Honorary Advisory Council for Scientific and Industrial Research.

A lubricating grease composition consisting essentially of mineral base lubricating oil thickened to a grease consistency with 1 to 20% by weight, based on the total composition, of a silica gel, said gel being waterproofed with 10 to 100% by weight, based on the dry silica content, of a linseed oil modified alkyd resin.

FILTRATION OF INDUSTRIAL AND LUBRICATING OILS

(*Continued from page 75*)

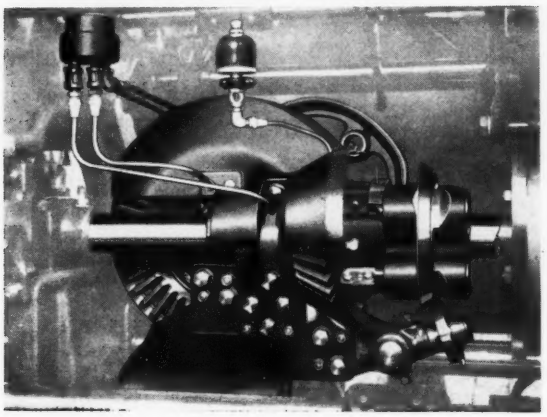

Fig. 4.
Bevel gear and pinion of the "Reading" Machine, showing lubrication by means of sight feed and multiple wick oilers.

reciprocating parts of the machine.

In addition to main bearings there are approximately 2,000 moving parts requiring lubrication at regular intervals ranging from once every eight hours to once every three months, many of which do not lend themselves to the application of any type of lubrication system, and must be oiled by means of the ordinary oil can.

Warp knitting machines of Tricot, Milanese and Rachel types as well as circular hosiery knitting machines will require essentially the same types of lubricants as those required for the operation of the full-fashioned machine. The lubricant used most generally on these machines is the stainless needle oil as specified by the manufacturers of circular hosiery machines. Here the problem is, with particular reference to the knitting of men's half-hose, how to lubricate the machine without staining the goods. It is a troublesome problem especially where ingrain knitting is practiced and particularly where the colors are pastel. It is also difficult to remove oil and metal stains from the gores in men's half-hose where bleaching or pastel dip-dying is to follow. The general practice followed is to use a small amount of oil on the needles with 2 applications for each 3-hour shift. And where the highest grade of needle oil is used the staining can be reduced to a minimum.

In conclusion, let it be said that proper lubrication of knitting machinery will depend not only upon the type and grade of lubricants used, but upon the personnel engaged in this important operation. It should be borne in mind that the individuals responsible for the lubrication of such equipment should understand its operation and know the respective parts that require lubrication and protection. Such personnel must also appreciate the bad effects that result from careless or sloppy application of lubricants. It is well to remember that in the lubrication of knitting machinery, as well as other types of machines, it is best to limit the use of oil in the application to the least amount that will adequately lubricate the working parts involved.

Only through proper maintenance and lubrication of this equipment, using the highest grade lubricants available, can satisfactory production be maintained over a long period of time.

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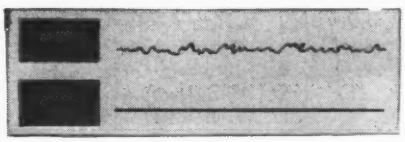
A major steel company examined a total of five lubricants in which 4 grams of each were tested. It was a laboratory experiment designed to approximate lubrication conditions for open gears and sleeve bearings. The results showed that Leadolene* Klingfast *gave almost three times the service of the next best lubricant, and up to five times the service of other lubricants tested.* All lubricants considered were of quality nature, and are widely used in open gear service.



Lower project line indicates safe lubrication as was the case with Leadolene Klingfast through the entire test. Upper project line indicates scoring.

To conduct the 4-Gram Test the steel company made certain alterations in the Timken Testing Machine, long considered standard for determining the breakdown point of lubricants. First the flow of lubricant to the ground steel block and cup was shut off. Then four grams of the lubricant being tested were applied at room temperature. The machine was watched closely and timed for scoring. In this way open gear and sleeve bearing lubrication conditions were reproduced for laboratory study.

The results of the 4-Gram Test are typical of the service Leadolene Klingfast will give you in actual use. *May we send details and a generous sample for your own testing?*

RESULTS
of 4-Gram Test

KLINGFAST . . . 30 minutes without scoring or failing.

LUBRICANT A . . . Failure: 12 minutes. Scored in 5 minutes.

LUBRICANT B . . . Failure: 8 minutes.

LUBRICANT C . . . Failure: 6 minutes.

LUBRICANT D . . . Failure: 6 minutes.

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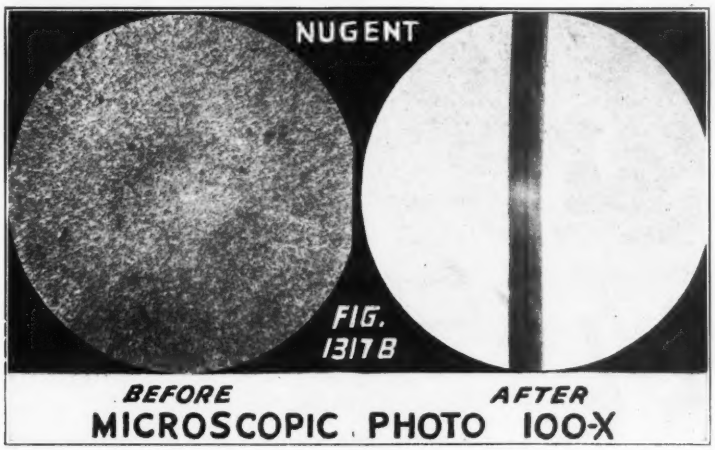
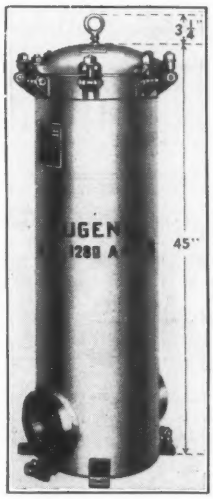


BEFORE AFTER

MICROSCOPIC PHOTO 100-X



The "before and after" photomicrographs reproduced above in positive proof of the ability of Nugent Filters to keep dirt out of the vital working parts of your equipment. And just to give you an idea of the magnification in this view, the dark line running vertically through the "after" picture is a human hair (.0025" dia.)!

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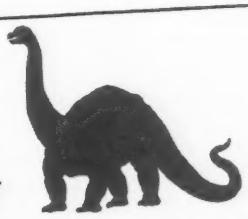

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CHLORINE	13%
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Used in hundreds of America's metal industries for the machining of all commercial steels and metals, irrespective of alloying constituents and machinability.
Competes with highly rated, specialized conventional cutting oils for specific and general use. Assures maximum performance in terms of tool life, finish and maintenance of size.

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- Boost Production— Save Repairs
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WRITE FOR BULLETIN No. 33

TRICO FUSE MFG. CO.

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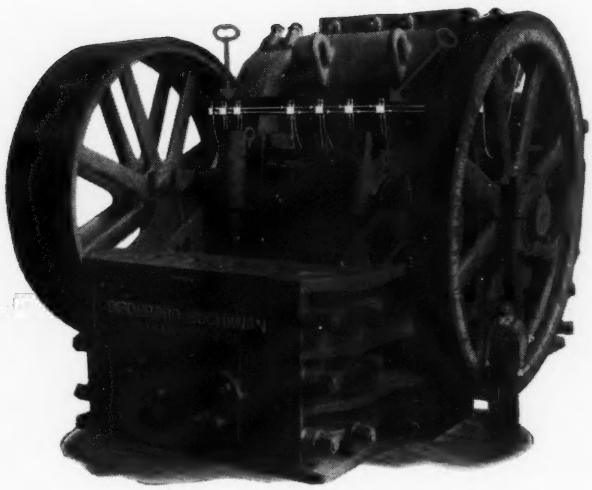
World's largest deep frame jaw crusher is protected by Farval lubrication

FARVAL—*Studies in Centralized Lubrication* No. 133



KEYS TO ADEQUATE LUBRICATION—*Wherever you see the sign of Farval—the familiar valve manifolds and dual lubricant lines—you know equipment is properly lubricated. Thus you can see there will be no bearing trouble on this Birdsboro-Buchanan crusher.*

This giant weighs 275 tons, stands 18 feet high, has a 66- x 84-inch jaw opening. It handles feed from a 5-cu.-yd. shovel, discharging a 14-inch product at the rate of 800 t.p.h. It is one of more than fifty thousand industrial machines whose bearings are protected by Farval.

Photo above by courtesy Birdsboro Steel Foundry & Machine Co.

IN the next few months, this mammoth machine will crush three million tons of diorite. Largest deep frame jaw crusher ever built, it is operating on the Detroit dam project in western Oregon.

A highly publicized feature of this project is the cooling of all the aggregates used in the concrete construction. The builder of this crusher insured that the bearings in his equipment would always run cool, too. He equipped it with a Farval Centralized Lubrication System.

With Farval on the job, no special oilers are needed, lubricant consumption is reduced, bearing life is extended indefinitely and shutdowns for oiling or bearing replacement are eliminated. In short, Farval insures that the crusher can work day in, day out, without interruption from overheated bearings, in doing its part to see that the great Detroit dam is finished according to schedule.

Farval is the original Dualine system of centralized lubrication for industrial equipment, proved practical in 25 years of service. The Farval valve has only two moving parts—is simple, sure and foolproof, without springs, ball-checks or pinhole ports to cause trouble. Through its full hydraulic operation, the Farval system unfailingly delivers oil or grease to each bearing—as much as you want, exactly measured—as often as desired. Indicators at all bearings show that each valve has functioned.

In or near your city there's a Farval engineer, ready to discuss your lubrication problems and suggest a proper system to meet your particular needs.

The Farval Corporation, 3267 East 80th Street, Cleveland 4, Ohio.

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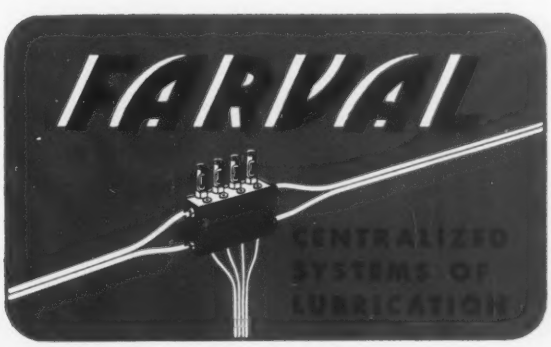

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